INEQUALITIES IN MENTAL HEALTH ACROSS URBAN CANADA

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ABSTRACT

Introduction

There is a plethora of research describing the inverse relationship between socioeconomic status, a social determinant of health, and an individual's health status. Inequalities, such as the discrepancy in health status by income, are harmful to a society's well being, socially, physically and economically. Mental health disorders are widely prevalent across Canada but are not well documented in terms of the social determinants of health or in terms of health inequalities. This thesis aims to increase knowledge pertaining to the presence of mental health inequalities in urban Canadian cities, as well as how the social determinants of health impact mental health outcomes.

Methods

This thesis was conducted in two parts:
The first part utilized fifteen years (2001-2015) of the Canadian Community Health Survey and three iterations of the Canadian Census of Population. Relative, absolute and overall mental health inequalities were calculated at the city, provincial and national level using self-reported mental health outcomes (Mood Disorder, Anxiety Disorder, Life Stress, and Poor Mental Health). Comparisons were made of prevalence rates and measures of inequality between cities and provinces, and over time.

The second study used the 2012 mental health component of the Canadian Community Health Survey. Fifteen variables describing various social determinants of health were individually fitted into simple logistic regression models, then together in multiple logistic regression models predicting the odds of having a Mood Disorder, Anxiety Disorder, Substance Use Disorder and Any Mental or Substance Disorder.

Results

At the national level, the prevalence of Poor Mental Health, Mood Disorders and Anxiety Disorders had significantly increased over time. Inequalities were present in all levels of geographies and were maintained or worsened over time. Prevalence rates and inequalities for Poor Mental Health, Mood Disorders and Anxiety Disorders were city dependent. They were more consistent when comparing cities of similar population than geographical proximity and no city could report a lack of inequality or constantly reported the highest level of inequalities.

Demographics, socioeconomic status, culture, mental health status, home life, and other categories were significant when added to the simple logistic regression models. The adjusted odds ratios differed in magnitude and direction by mental health outcome when added to the multiple logistic regression models.

Together these results point towards a need for increased city and social determinant specific data surrounding mental health in urban Canada.

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LIST OF ABBREVIATIONS

AD:	Anxiety Disorder
APA:	American Psychological Association
CCHS:	Canadian Community Health Survey
CI:	Concentration Index
CMA:	Census Metropolitan Area
CSDH:	Commission on Social Determinants of Health
DA:	Dissemination Area
DRD:	Disparity Rate Difference
DRR:	Disparity Rate Ratio
DSM:	Diagnostic and Statistical Manual of Mental Disorders
LS:	Life Stress
MD:	Mood Disorder
OR:	Odds Ratio
PMH:	Poor Mental Health
PCCF+:	Postal Code Conversion File
SE:	Standard Error
SES:	Socioeconomic Status
SDOH:	Social Determinants of Health
UPHN:	Urban Public Health Network
WHO:	World Health Organization

PREFACE

The work in this thesis is a subset of a greater project, Measuring Trends in Health Inequalities, spearheaded by the Urban Public Health Network (UPHN) to quantify and track health inequalities in Urban Canada. This thesis examines a small portion of health indicators that together provide a picture of Health Inequalities in Canada.

This thesis is arranged in six chapters. Chapter One serves as an introduction to the thesis, including the overall objectives, research questions, and relevance of the thesis. Chapter Two is a review of the current literature surrounding theories of social determinants of health and their relationship to mental health, select mental health disorders, social determinants of mental health and health inequalities in Urban Canada. Chapter Three outlines specific methodological decisions that were made in each of the two manuscripts. Chapters Four and Five are individual manuscripts that work towards answering the research questions that are found in Chapter One and can be taken as "stand-alone" chapters. Chapter Four (Manuscript One) will answer the first two research questions, discussing the prevalence and inequalities in mental health in Urban Canada. Chapter Five (Manuscript Two) discusses the Social Determinants of mental health Inequalities. Chapter Six provides an overview of the results of both manuscripts, discusses the implications of the results and provides suggestions for future work. Appendices follow Chapter Six.

1. INTRODUCTION

1.1 A Brief Introduction to the Social Determinants of Health

The concept of the social determinants of health is not a new one. There has been documented interest in public health concerning the relationship between social status and health outcomes as early as the nineteenth century. [1] In more recent history, in 1948 the World Health Organization (WHO) was established with a Canadian Director-General. [2] The WHO solidified the health field's acknowledgment of the importance of the social determinants of health by including "social well-being" in their definition of health within their constitution. [3]

Since then, renewed interest in the social determinants of health (SDOH) was sparked by the Whitehall Studies of British civil servants; the principal investigator, Sir Micheal Marmot, later became the Chair of the Commission on Social Determinants of Health for the WHO. [4] These long-term cohort studies conclusively related the social standing of the cohort members and their mortality rate. That is, low social standing is correlated to a high mortality rate. [5] The WHO remains committed to the study of the SDOH and regularly releases information and resources pertaining to the subject. [6]

Canada also has a long history of Public Health interventions related to the SDOH that dates back to its confederation. [2] However, Canada's first official recognition of the Social Determinants of Health did not come until 1974 in the form of the Lalonde Report. [7] Canada has continued to progress in this work and its recognition of its importance is well documented; the Canadian Public Health Association counts "Acting on the social determinants of health" as one of its 12 greatest achievements.

The Government of Canada has continued focused research on the determinants of health and has officially identified 12 main determinants: [8]

- Income and social status
- Employment and working conditions
- Education and literacy
- Childhood experiences
- Physical environments
- Social supports and coping skills
- Healthy behaviours
- Access to health services
- Biology and genetic endowment
- Gender
- Culture
- Race/Racism

However, this list contains more than strictly social determinants and is not an exhaustive list. PHAC actually titled this list "Determinants of health", stating that the social determinants are a subset of this more general list that focus on social and economic variables, though it does not specify which of the 12 determinats qualify as a SDOH. [8] When reported by other organizations within and beyond Canadian borders, the lists describing determinants or social determinants of health vary. [9–11] For example, the list of social determinants provided by the Canadian Public Health Association has different wording and includes categories such as Food Insecurity, Aboriginal Status and Disability. [9] Determinants also differ by population: it is

impossible to consider determinants of health for Indigenous people separate from Canada's history of colonialism. [12] These differences highlight the fact that the idea of social determinants of health describes a complex, interdisciplinary, and multifactorial concept that is difficult to reduce to a list or diagram.

Regardless of the exact list, the premise that health is affected by more than biology is accepted across scientific communities. Progression in laboratory research has confirmed the underlying assumptions made by public health campaigns over the last centuries: environment matters. Studies have suggested that biology and physiology, including hormones, brain structures and genetics, are affected by the social environment. [13–16]

The practical implications of the SDOH mean that health can no longer be treated just as a biological condition. This was emphasized by the Director-General of WHO, who said: "Interventions aimed at reducing disease and saving lives succeed only when they take the social determinants of health adequately into account". [17]

The concept of SDOH forms the foundation of this thesis. Income is touted as the most important SDOH. [18] So when examining reasons for inconsistent health status in that in a country with acclaimed universal health care, it is an obvious step to examine the health of the population in terms of the SDOH [19] and income in particular.

1.2 A Brief Introduction to Mental Health

Mental health also has a long and complicated history. In ancient times individuals with mental health disorders were considered to be possessed by evil spirits, or cursed by the gods. Treatments of exorcism or solitary confinement reflected these suspicions. [20] By medieval times asylums and physical restraints were common maladies for supposed mental health disorders. [21] Modern medicine has progressed the understanding, diagnostic process and treatment of mental health disorders. Following the Second World War, the American Psychological Association (APA) published the first version of the Diagnostic and Statistical Manual of Mental Disorders (DSM), outlining diagnostic categories that followed the psychological views of the time. In 2013 the fifth and most recent edition of the DSM was released. [22]

With all the progress that has shaped how society sees the Social Determinants of Health and mental health disorders, we still do not know enough about the relationship between income and mental health disorders.

1.3 Statement of the Problem

Research has shown that there is a clear inverse relationship between socioeconomic status and health, forming health inequalities. Inequalities are harmful to a society's well being, socially, physically and economically. Mental disorders are widely prevalent across Canada, but are not well documented in terms of socioeconomic status; there is a lack of consistent research reporting inequalities in mental health disorders in Urban Canadian cities. This makes between city comparisons, and comparisons over time of mental health inequalities difficult. Additionally, the unique attributes of Canadian cities mean that the determinants of inequalities might not be universal across Canada. Understanding the levels of inequalities in each city and as well as deconstructing the inequalities will be essential in working towards their elimination, resulting in the improvement of the health of all Canadians.

1.4 Statement of Purpose

Knowledge is power. The underlying purpose of this thesis is to work towards having the correct knowledge of mental health in order to empower policymakers to implement change to reduce the disparity in Health in Canada. Low-income neighbourhoods have a higher prevalence of mental health disorders, but there are often structures in place with the given purpose of reducing the extent of the inequalities in urban communities. This study will provide background information on the characteristics of the population that most influence inequalities, that can be used by policy-makers to determine which social structures are most effective and should be implemented or altered to reduce health inequalities.

This study will work towards filling the gap in knowledge concerning urban Canadian mental health inequalities in two ways. Firstly, this study will quantify and compare the inequalities in mental health between urban cities across Canada and describe how these inequalities are changing over time. Secondly, this study investigates whether or how an evaluation of the determinants of mental health in urban Canada could help inform the most effective measures to counter mental illness in areas of low socioeconomic status by highlighting the factors that have the most significant contribution to mental health.

1.5 Research Objectives

1. Determine the prevalence of mental health in cities and provinces across urban Canada between 2001 and 2015.
2. Determine the trends in inequalities in mental health in cities and provinces across urban Canada between 2001 and 2015.
3. Determine the relative impact of variables describing SDOH on mental health in urban Canada in 2012.

1.6 Research Questions

1. How does the prevalence of mental health indicators differ in cities and provinces in urban Canada?
2. How are inequalities in mental health changing in urban Canada?
3. What factors most influence the prevalence of mental health and addictions in urban Canada?

1.7 Organization of Thesis

The following chapters work together to address the research objectives and answer the research questions. Chapter Two outlines the current literature and theories surrounding the SDOH, mental health and addictions, and health inequalities. Chapter Three discusses the methodology used in the manuscripts in Chapters Three and Four. Chapter Four contains the first manuscript and evaluates trends in mental health prevalence rates and inequalities. In doing so, it covers research objectives 1 and 2 by answering research question 1 and 2. The second manuscript is found in chapter Chapter Five, which addresses the third research objective and research

question. Finally, Chapter Six summarizes the results of the two manuscripts in the context of the theoretical framework and current literature, then offers suggestions for further research.

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2. LITERATURE REVIEW

This chapter outlines the literature surrounding social determinants of health, mental health and health inequalities. It begins with describing theories of social determinants of health, then outlines the framework which has been adopted for this study. Next, it describes the mental health disorders which are used as outcome variables in following the manuscripts. A review of the literature about the social determinants found in the framework relating to mental health disorders follows. Finally, a review of the current literature about inequalities in mental health is provided.

2.1 Theories of the Social Determinants of Health

Two sets of theories are needed to begin to postulate ideas concerning inequalities in mental health and addictions.

The first group of theories, the theories of social epidemiology, broadly describe the relationship between biology and social structures. These theories are necessary to the underlying assumptions of this thesis- that a variety of social structures impact physiological health.

The second set of theories is specific to mental illness and socioeconomic status. These theories aim to describe why there is a greater proportion of mental illness in populations with low compared to high socioeconomic status.

2.1.1 Theories of Social Epidemiology

Theories of social epidemiology first appeared in the 20th century and attempt to explain how biology and social structures are related. [1–3]

There are currently a number of widely accepted theoretical approaches and pathways to explaining the relationship between the social determinants of health and health. These can, in general, be sorted into three categories: the Psychosocial Approach, Social Product of Disease or the Political Economy of Health, and the Ecosocial or other multilevel frameworks. [1–3]

2.1.1.1 The Psychosocial Approach

The psychosocial approach explains the interaction between society and biology with the intermediate stress. It states that poorer physical health is due to past and present stresses of the external environment to which the body is forced to respond. One of the underlying assumptions of the psychosocial approach is that diseases are "ubiquitous" and in an equal society, the disease would be uniformly distributed. [1]

However, the theory states that stress, from lack of resources, or perceived stress due to comparison to higher social classes, alters susceptibility to diseases to the detriment of those in lower social classes. [1,3] Therefore, stress can be considered a risk factor for disease and illness or less ideal functioning of the body of those living in worse societies can be attributed to the stress placed on them. [2]

Said another way, 'psychosocial' can be defined as, "pertaining to the influence of social factors on an individual's mind or behaviour, and to the interrelation of behaviour and social factors." [4] The psychosocial approach thus explains how social factors, such as losing a job or experiencing homelessness, cause distress which influences physiological functioning and reduces health. [3,4]

The psychosocial theory has received support from many researchers, particularly those investigating economic inequality and health studies, and has scientific support from research on neuroendocrine patterns due to social stresses. [3] Notably, Sir Micheal Marmot and Richard Wilkinson, leading scientists in the field of health inequalities, lend support to this theory. [5]

2.1.1.2 Theory of Social Production of Disease and Political Economy of Health

The second category of theories combines ideas from the theory of social production and the political economy of health approach. It cites the influence of structural material resources, or lack thereof, as a determinant of health. It places a greater emphasis on the political and economic determinants that form structural resources, that are typically less available to those in lower levels of society, rather than perceptions that lead to stress described in the psychosocial theory. [3]

This theory was originally designed to combat the "blame the victim" mentality that was the historical explanation for poor health. The shift from internal or individual factors to claiming that good or poor health stems from who can benefit from social policy removed the blame for poor health from the individual to society, or more specifically, the social policymakers. [1,3]

The Fundamental Cause theory, which is structured around the concept of flexible resources that are "social, economic and political structures" is an example of a theory that would fit into this category. [6] Geoffrey Rose's pivotal paper titled "Sick Individuals and Sick Populations" also contains ideas of population-specific material resources that would be considered part of the Theory of Social Production of Disease. [7,8]

2.1.1.3 The Ecological and Multilevel Theories

The newest category of theories takes advantage of modern statistical developments to describe health from a multifaceted, complex and dynamic perspective. [1,3]

One paper, describing the benefit of studies that use multilevel theory, stated "the relative importance of individual and social factors or the interaction between individuals and social factors, permitting several levels of analysis to be controlled for simultaneously." [2]

An example of this type of theory is the ecosocial theory which was developed by Nancy Krieger in the 1990s. It acknowledges that health is impacted by the constantly changing environment that an individual experiences. The ecosocial theory combines social production in a multilevel model with biological and ecological factors to describe disease. [1,3]

2.1.2 Theories relating to Social Position and Mental Illness

Theories relating to Social Position and Mental Illness explain the well-established fact that the prevalence of mental illness is higher in populations of low social position compared to high social position. In brief, these theories attempt to explain which factor preceded the other; mental illness as a cause for low social position, or low social position as a risk factor for mental illness.

There are three theories relating to this concept. First, the Theory of Social Selection argues that mental illness precedes low social status. Its' competing theory, Social Causation argues the opposite- low social status is a risk factor for mental illness. The final theory, the Life Course Perspective operates outside both the aforementioned theories and proposes that there are alternative factors that affect both social status and mental illness.

2.1.2.1 Social Causation

The Theory of Social Causation, first described in 1903 by Franklin Giddings, but expanded upon during the last century, suggests that social status dictates mental health. [9] It suggests that social position, through the material intermediates of the psychosocial, behaviour and biological aspects that correspond with social position influence an individual's mental health. [3,10]

According to the Theory of Social Causation, the imbalance of health within levels of social status can be achieved through considering social status as a risk factor or a protective factor for health for those in low or high social status, respectively. [3] For example, income could be considered a protective factor for an individual with high income who would be able to afford healthy foods or a personal trainer which is known to increase health. As a risk factor, an individual of low social status who did not possess sufficient means to live, which in turn caused that individual stress, and this stress negatively impacted that individual's health.

2.1.2.2 Social Selection or Drift Theory

The opposing theory, Social Causation or Drift Theory, suggests that mental health is the causal factor for social status. [10] This theory describes how health influences the attainment of social position. In turn, social position causes social mobility either compared to an individual, which is known as intragenerational mobility or compared to an individual's parents, which is known as intergenerational mobility. [3]

Contrary to Social Causation, in Social Selection, it is a social position, not health which is considered a risk factor or protective factor. For example, if a child was chronically sick, they would not be able to attend school, and their education would suffer and health could be considered a risk factor for educational attainment. [11] Alternatively, a healthy child might be more prone to exercise, which is proven to be good for learning, and so health could be considered a protective factor. [12]

Research also supports this theory in mental health. Studies of Bipolar Disorder found that many patients do not regain full social or occupational domains after a Bipolar episode. [13,14] Other studies show that individuals with Major Depressive Disorder have a 60% increased odds of not completing secondary school. [15]

2.1.2.3 The Life Course Perspective

Finally, the Life-course perspective is focused on time and timing of the factors that affect health. [3] This includes both the amount of time that a factor is affecting the individual and the time in the individual's life that the factor is present. For example, the correlation of health with social status has been found to increase with age. [11] The life course perspective examines the SDOH at each stage of development within individuals and populations and across generations, then extrapolates trends to a population level. [3]

The Life-course Perspective places special emphasis on the factors affecting health at "critical periods" of development, as well as the "accumulation of risk" caused by stressors over time. [3] The Life-course perspective can, therefore, be thought of as operating outside of the social causation/ social selection debate, not considering the relationship between mental health and SES in an either/or theory scenario, but both. Advocates for the life course perspective postulate that each theory is favoured at different life points. [16]

Studies that support this theory also introduce the idea that health and SES can both be affected by and affect unknown background factors. [11] These factors can affect both social status and health status, acting as a confounding variable in the debate of causation.

2.1.2.4 Support for Theories Relating Social Position to Mental Illness

Each of the theories relating Social Position to Mental Illness has numerous studies conducted that support its validity. [10,17,18]In their recent systematic review, Kroger et al found that of the 24 studies selected, 12 preferred social causation and 10 preferred social selection. Additionally, they stated that the preferred theory often was dependent on the dimension analyzed and the statistical procedure used. [19]Even in the same study, the same theoretical model was not consistently supported. Johnson et al found that the main causal contributor (social position or health status) was dependent on which mental health disorder was evaluated. [20] However theorists today generally agree with the life course perspective, in that health or social status are not determined by the causal pathways suggested by either social causation or social selection but a combination of both operating at different levels over the life of an individual. [16,19,20]

2.1.3 A Social Determinants of Health Framework

Numerous frameworks and models have been developed to portray the effects of the Social Determinants of Health, which prompts discussion concerning the best or most appropriate framework. [21] Only four have been developed in recent years, and no "gold standard" model exists for describing the SDOH. However, the model developed by the WHO is the most comprehensive and dynamic and is also aimed at producing materials appropriate for intervention. [22] The model is commonly used; at the time this paper was written, it has been cited by over 1500 articles.

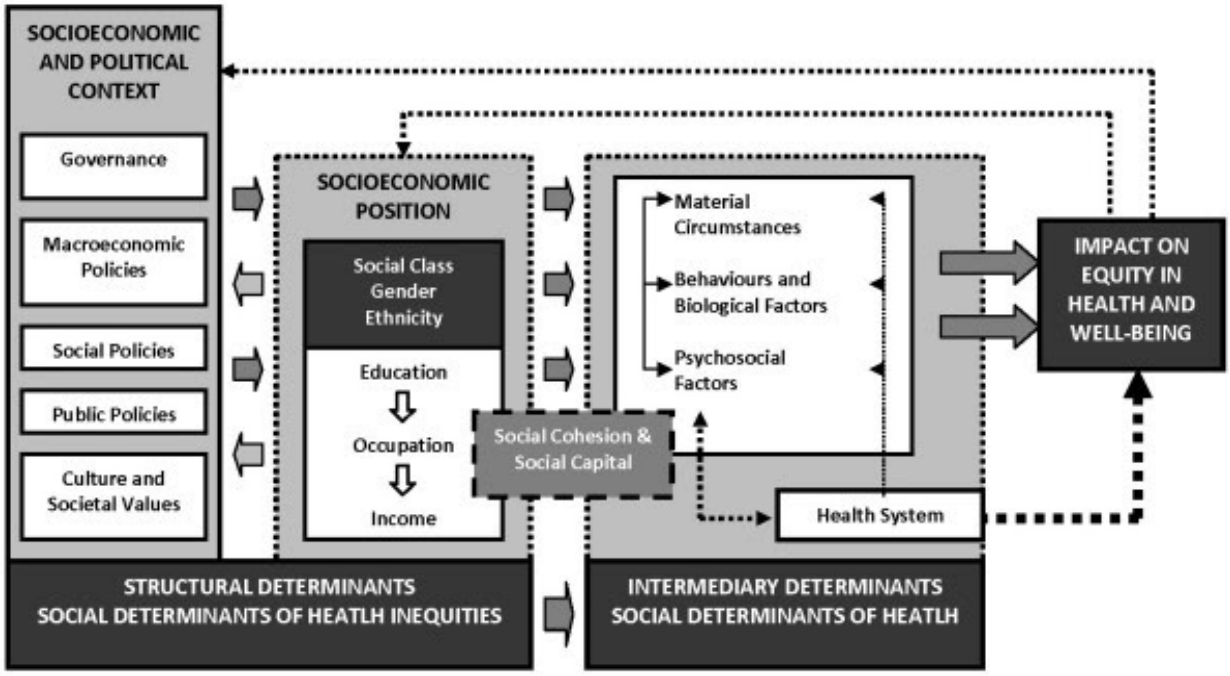

Figure 2.1: Commission on Social Determinants of Health Conceptual Framework [3]

For these reasons, as well as due to its broad perspective and intent to facilitate policy change, [3] I chose to follow the methodological framework outlined by the World Health Organization (WHO). The framework is described in detail in a 2010 report released by the WHO. [3]

In brief, the Commission on Social Determinants of Health (CSDH) model suggests that aspects of all of these theories have an impact, and further suggests that each pathway has the potential to influence health. The model, therefore, utilizes aspects from all of the theoretical approaches (Figure 1). It separates factors into categories of socioeconomic and political context, structural determinants and socioeconomic determinants, and intermediary determinants, but stresses their interconnection.

The WHO included many determinants of health in their model, more than simply the social determinants. In fact, factors typically considered to be social determinant are contained only in the socioeconomic position branch of the structural determinants section. This emphasised the complexity of factors that impact and are impacted by the seemingly narrow category of SDOH.

The framework also points to causal pathways. Within the SDOH branch all the factors lead down to income, while that branch is cyclically related to socioeconomic and political contexts. The SDOH branch then influences the intermediate health determinants which in turn influence equity in health and well-being. However, there is not one factor or branch that predominates the model or implied causal pathway.

This study will function under the same understanding as that described in the CSDH model. I will approach the interrelation of factors that influence the SDOH, the SDOH and mental health as inseparable. I will recognize that there are factors outside of those that are considered in the present study, which influence the chosen outcomes. The limited information available within the dataset shaped many of the methodological decisions as well as the interpretation presented within this thesis. For example, factors such as access to healthcare, illustrated in the bottom right of the model, was not included in this thesis. As access to health care is a large determinant of health for rural over urban populations, the rural population was excluded from analysis. This is explained in further detail in the following chapter. In general, this study will focus on the impact of the structural determinants of health inequality, realizing that there are other macro and micro factors missing.

2.2 Mental Health

2.2.1 Mental Health

Like most definitions pertaining to health, the definition of mental health is multifaceted and multidimensional. [23]

The WHO defines mental health as “a state of well-being in which every individual realizes his or her own potential, can cope with the normal stresses of life, can work productively and fruitfully, and is able to make a contribution to her or his community.” [24] Other sources describe mental health as an individual's ability to think, behave, deal with daily stressors, enjoy life, solve problems, as well as knowing and accepting oneself. [25–28] It is thought to be affected by a combination of genetic, biological, personality and environmental factors. [29]

Mental health is not just the absence of mental illness. [30] The Canadian Mental Health Association explains that not everyone will be diagnosed with a mental illness, but everyone will struggle with mental wellbeing. Because mental health acts on a continuum, an individual can

have poor mental health without a mental illness, or can have good mental health and still be diagnosed with a mental illness. [31] This emphasizes the importance of material and social factors that can be used to treat mental illness or improve mental health.

However, because most modern medicine is concerned with finding remedies for pathologies rather than preventing them [32] there are many more guidelines describing what constitutes poor health is instead of good health. That is because as a society we are better at classifying disease instead of health, health is often functionally diminished to "an absence of disease."

Similarly, this study examines the presence of mental illness in Canada. The title including "mental health" may be considered misleading as it is not a study of positive mental health, [33] but is following standard convention.

2.2.2 Mental Health Disorders

This study examines seven disorders, specifically Major Depressive Disorder, Bipolar Disorders, Mania, Hypomania, Anxiety Disorder, Drug-Related Disorder and Alcohol-Related Disorder.

2.2.2.1 Mood Disorders

2.2.2.1.1 Bipolar and Related Disorders

Bipolar Disorder was first described as Manic-Depressive Disorder because physicians observed that individuals with this disorder experienced episodes of both mania and depression. [34] With advances in medical knowledge, the definition and criteria for Bipolar Disorder have changed and Bipolar Disorder is now separated into Bipolar I and Bipolar II Disorder.

In the DSM-5 the Bipolar and Related Disorder chapter includes diagnostic information for Mania and Hypomania. However, Mania and Hypomania are not considered independent disorders but describe episodes that form the basis of a Bipolar Disorder diagnosis. [35]

Mania

Manic episodes are "a distinct period of abnormally and persistently elevated, expansive, or irritable mood and abnormally and persistently increased goal-directed activity or energy". [35] Symptoms of manic episodes include a sense of grandiose, decreased need for sleep, talkativity, racing thoughts, distractibility, increased goal-directed activity, psychomotor agitation, and engagement in high-risk activities.

A person with Bipolar Disorder may describe Manic Episodes as "feeling on top of the world." They may start many new projects, only need to sleep for a few hours each night, have increased creativity, be overly talkative, and show poor judgment. [35]

Hypomania

The symptoms of Hypomania are very similar to Mania. However, in hypomania the symptoms are not severe enough to impair day-to-day functioning, though they do cause a change in behaviour from when the individual is not symptomatic.

Bipolar II Disorder is considered a subset of Hypomania. All individuals with Bipolar II Disorder experience Hypomania, but not all individuals who experience Hypomania are diagnosed with Bipolar II Disorder. [35]

Bipolar I

Bipolar I Disorder (BID) was formerly known as Manic Depressive Disorder or Affective Psychosis. BID is diagnosed by the presence of a manic episode. Individuals with BIP commonly, though not necessarily, experience psychosis, hypomania or major depression.

There is a spectrum of severity within BID. The DSM-5 includes rating the severity of BIP from mild to severe. BIP can be diagnosed alongside a number of specifiers (ie with anxious distress, with rapid cycling, with catatonia).

The average age of onset of individuals with BIP is 18 years. Most individuals who have BIP have recurring episodes of mania or depression. [35]

The genetic and broader biological components of Bipolar Disorder are not well understood. It is suggested that there is a genetic component to Bipolar Disorder, though complex, and genetics are not considered as significant a predictor for Bipolar Disorder as some in other mental health disorders, such as schizophrenia. [36]

Bipolar II

Bipolar II Disorder (BIID) is a subset of hypomania. Individuals diagnosed with BIID must have experienced at least one episode of hypomania and one major depressive episode. BIID is associated with heightened creativity but also impulsivity which can lead to suicide attempts and Substance Use Disorder.

The average age of onset of individuals with BIIP is mid-20s. [35]

Individuals with Bipolar Disorders are treated to control their symptoms of mania and depression. This is most effectively done with the combination of medication and psychosocial therapy. Medications include mood stabilizers, atypical antipsychotics such as lithium and antidepressants. [37,38]

2.2.2.1.2 Major Depressive Disorder

Major Depressive Disorder (MDD) is generally associated with feeling sad, worthless, helpless, empty or experiencing a loss of interest in activities[34,39] It is characterized by “clear-cut changes in affect, cognition, and neurovegetative functions and interepisode remissions”. [35]

Diagnosis of MDD must include symptoms of a depressed mood or loss of interest or pleasure. Other symptoms can include weight loss or gain, insomnia or hypersomnia, psychomotor agitation or retardation, fatigue, feelings of worthlessness, diminished ability to think, and recurrent thoughts of death. [35]

There is a large variability in the age of onset and length of time individuals experience MDD. [35]

MDD is treated with medication and therapy. There are many antidepressant medications that are effective in reducing the symptoms of MDD. [40] Therapy can include interpersonal and cognitive psychotherapy, somatic therapies and in some circumstances, electroconvulsive therapy. [41]

2.2.2.1.3 Generalized Anxiety Disorder

Generalized Anxiety Disorder (GAD) is characterized by excessive, long term worry. GAD can stem from any of a variety of fears that cause physical symptoms. [34] It is differentiated from other anxiety disorders such as Separation Anxiety Disorder, Panic Disorder or Phobias.

GAD is marked by the presence of anxiety and worry about a number of events or activities. Symptoms include restlessness, fatigue, difficulty concentrating, irritability, muscle tension and sleep disturbance. An individual with GAD will experience worry out of proportion to the coming event that they cannot control. They may also experience sweating, nausea, diarrhea, or headaches. [35]

The average age of onset of individuals with GAD is 30 years old, though there is a broad age range where GAD is experienced. [35]

Like both BD and MDD, GAD is treated with medication and therapy. Therapies include nondirective, applied relaxation, and cognitive behavioural therapy. [42] There are also many medications that are effective in reducing the symptoms of GAD. [43]

2.2.2.1.4 Substance-Related and Addictive Disorders

Substance-Related Disorders describe the use and dependence on substances that impact a person's day-to-day functioning. Among others, substances can include gambling, alcohol, cannabis, cocaine, amphetamines, opium, heroin, tobacco, and caffeine. [34,35] Substance-Related and Addictive disorders are often related to peer pressure and can be influenced by the media. [34]

The DSM-5 lists 10 classes of drugs: alcohol, caffeine, cannabis, hallucinogens, inhalants, opioids, sedatives hypnotics and anxiolytics, stimulants, tobacco and other. [35]

Substance-Related Disorders occur when substances activate the brain's reward system. Changes in the brain circuit caused by a substance can lead to dependence and misuse of the substance. An individual is diagnosed with a Substance-Related Disorder when the individual continues to take the substance despite adverse cognitive, behavioural and physiological symptoms.

Symptoms of Substance-Related Disorders are combined into categories of impaired control, social impairments, risky use, and pharmacological criteria which include the symptoms of tolerance and withdrawal.

There is a broad range of severity of Substance-Related Disorders that are designated by the number of symptoms the individual experiences.

Treatment of Substance-Related Disorders involves detox, psychotherapy, relapse prevention and pharmacotherapy. [44–46]

2.3 Social Determinants of Mental Health

This section outlines the current literature relating to Mood Disorders, Anxiety Disorders, and Substance Use Disorders to the SDOH, including gender, ethnicity, age, sexuality, chronic conditions, marital status, and socioeconomic status.

2.3.1 Sex

The effect of gender on mental health disorders has been readily studied. Gender differences are present in the overall mental health of Canadians. In general, women experience slightly more mental health disorders than men, though this is largely dependent on the nental health disorder being considered. [47,48] Beyond the descriptive statistics of mental health disorders, males and females experience the disorder differently, with varied age of onset, chronicity, and levels of lifestyle impact. [49–51] Studies cite structural and lifestyle and psychosocial events that may contribute to these differences. [52]

These gender differences are exemplified when considering Bipolar Disorder. Overall, the number of males and females living with Bipolar Disorder is roughly equal. [50,53,54] However, there are differences in the type of Bipolar Disorder experienced by each gender and the experiences of living with Bipolar Disorder differ between males and females.

Bipolar II Disorder, which is classified as containing hypomanic and depressive episodes, are more common among women. [50,54] Males are more likely to experience the comorbidity of Alcohol Use Disorder and Bipolar Disorder, [50,54]while females are more likely to experience the comorbidity for Anxiety and Bipolar Disorder. [54]

Studies also suggest that females will experience a later onset of Bipolar Disorder, experience longer and more frequent depressive episodes. Conversely, males have an earlier onset and have more severe and frequent manic episodes. [50]

Gender Differences in Major Depressive Disorder is much more pronounced than in Bipolar Disorder. [53] Females are almost twice as likely to experience depression as males. [51,55,56]

Studies suggest that gender differences in the internalization of stress, and hormones as possible causal factors for this discrepancy. [55,57] Other studies suggested that women were more likely to report depression, but men were less likely to receive help but are more likely to act on depressive symptoms and develop Alcohol Use Disorders or attempt Suicide. [58,59]

Gender differences in age of onset and duration suggest that females also experience depression at a younger age and experience depression for a longer duration. [60]The gender gap is modified by other SDOH such as having a family, socioeconomic status and cohabitating with a partner. [61]

Generalized Anxiety Disorder also affects males and females at different levels. Similar to Major Depressive Disorder, 1.7 times more females experience anxiety than males. However, there is no gender difference between the age of onset or the chronicity of the disorder. [51] Studies also suggest that females are more likely to miss work or visit the Emergency Room as a consequence of anxiety, while males are most likely to have comorbid Substance Use Disorder (SUD). [51]

Finally, more males than females experience SUD. [53,62] Males are twice as likely to experience drug or alcohol abuse as females. [62] The phenomenology of SUD for males is also different. Males with SUD are more likely to lose their jobs, while women are more likely to be divorced. Due to the increased stigmatization against women with SUD, women are more likely to drink away from home. Women are also more likely to get drunk and develop liver disease faster because of physiological differences. [49]

2.3.2 Age

Reporting the relationship between age and a mental health disorder can be done using the average age of onset of a disorder or by examining the point prevalence by age group of the disorder.

The age of onset measure is especially valuable when considering lifetime prevalence. The age of onset for mental health disorder is variable among and within disorders. Studies report that Anxiety Disorders have the earliest average age-of-onset at early or pre-adolescence

years, followed by Substance Use Disorders at late adolescence to early adulthood, and Mood Disorders had an age-of-onset at 30 years old. [15,47,63] Though the authors state that this is highly variable, depending on the specifics of the disorder and especially amongst Mood Disorders, for which they reported have an onset range of 25 years. [47]

In some disorders, the age of onset also corresponds to the highest prevalence. The age of onset and prevalence of Substance Use Disorders is highest in late adolescence and early adulthood [62] This trend is also similar in Mood Disorders.

When considering point prevalence Mood Disorders, studies indicate that depression is less common in persons under the age of 18, but steadily increased throughout the teenage years and that the increase begins to decrease after adolescence. [64,65] Studies have contradictory explanations for Mood Disorders in older age groups, with some studies claiming that depression declines with age or individuals over 60 experience the least mental health disorders and others reporting a large prevalence of geriatric depression. [15,47,66] Studies also show that the effect of age on depression varies across countries and that early onset of depression can be especially problematic later in life. [15,67]

2.3.4 Sexuality

Individuals identifying as homosexual (lesbian or gay) or bisexual experience worse mental health than individuals identifying as heterosexual. This effect is modified by factors such as sex and social surroundings.

Bisexual individuals experienced more Mood and Anxiety Disorders than homosexual and heterosexual individuals [68–71] Bisexual and homosexual men reported anxiety prevalence rates of 20%, 11% respectively compared to heterosexual men (5%). [69] Similarly, bisexual or homosexual men are up to 3 times more likely to experience depression than heterosexual men. [68,70,72] However, studies differed on the impact of homosexual, bisexual, or heterosexual individuals and Substance Use Disorders. Some studies found no difference between homosexual, bisexual and heterosexual individuals and SUD, while other reported higher rates among homosexual and bisexual men and women. [68,70,72]This effect was decreased if the individual was in a committed relationship, was “out” (in lesbian women, but not bisexual women) and had an education. [73]

Studies point to the “Minority Stress Theory” to explain this effect. [69,74] The theory describes how increased levels of stress experienced by members of a minority group due to discrimination and prejudice lead to poor mental and physical health. [70]

2.3.5 Marital Status

As previously mentioned, being in a committed relationship can act as a protective factor against mental illness. [73,75] Marriage was associated with lower rates of D, Anxiety and Substance Use Disorders in men and women, but gender and age differences contributed to the effect. [76,77]

However, individuals who are separated or divorced experience higher rates of Depression and Alcohol Dependence than individuals who are married. [15,78,79] Major Depressive Disorder can both contribute to marital disruption and be caused by divorce or separation. [80]

2.3.6 Ethnicity

In international studies, it is difficult to separate the effect of ethnicity and culture on mental health. Global depression and anxiety studies found huge discrepancies in the prevalence of Major Depressive Disorder. [15,64,81] One such study described a range from 73% in Afghani women, to 0.05% in Japan. [64]

Canadian literature does not consistently report ethnicity in a uniform way, making it difficult to extrapolate concrete trends. [82] Studies reported contradicting results of the effect of ethnicity on mental health in Canada. [83–85] However, a number of studies reported lower rates of Mood and Anxiety Disorders in Asian and Black ethnic backgrounds compared to white. [47,83,86,87] This same study reported, rates of self-reported health and community belonging were the lowest amongst Chinese individuals. [86]

2.3.7 Immigration Status

Immigration and health often are discussed in terms of the Healthy Immigrant Effect, the idea that immigrants are often among the most healthy of their country of origin, and are generally more healthy than the native-born of the country to which they immigrate. [88] The Healthy Immigrant Effect is also found to be consistent with mental health, that is immigrants tend to have better mental health than non-immigrants. [89,90] However, this effect is complex, and is dependant on the age at immigration and the amount of time since immigration; there is not a large effect for younger immigrants and the health of immigrants tends to regress to that of the native-born. [84,91–93]

Compared to native-born, immigrants are less likely to experience Bipolar Disorder and have a slight to no higher risk of developing Bipolar Disorder. [94,95] Immigrants are less likely to experience depression, with the lowest rates amongst recent immigrants. Pahwa et al found a "U-shaped" relationship between the length of stay in Canada (>2, 2-20, 20< years) and mental health disorders. [91]

In terms of alcohol consumption, rates were determined by what region the immigrants' country of origin was, but regardless, also experienced a regression to the norm. [84] However, Alcohol Dependency was lower in immigrants than Candian born population, with the lowest rates amongst recent immigrants. [96]

Immigrants were less likely to experience a Mood or Anxiety Disorder, but the magnitude of the effect depended on ethnic origin and age of arrival to Canada. [97]

2.3.8 Chronic Conditions

The association between chronic physical health conditions and mental health is considered to be bidirectional. Mood, Anxiety and Substance Use Disorders can be considered both risk factors for chronic conditions such as obesity, heart disease, and liver disease and the product of other disorders such as cancer or chronic pain. [15,98]

Depression is associated with many chronic conditions, including arthritis, asthma, cancer, cardiovascular disease, diabetes, hypertension, chronic respiratory disorders, and chronic pain. [15,98,99] Individuals with chronic conditions are more likely to have depression. [100] However, the causal pathway is not unidirectional. For example, when considering cardiac disease, unmanaged stress associated with depression can increase cortisol which affects blood pressure and heart physiology. Additionally, social habits associated with depression such as smoking, alcohol consumption, limited exercise and social support are detrimental to heart

disease treatment. [101] In this way, depression can be seen as a risk factor for cardiac disease Conversely, recovering from cardiac disease, or heart surgery involves a long recovery, can increase stress, cause troubles sleeping and decreased mobility, which in turn are risk factors for depression.

Similarly, anxiety is associated with chronic conditions such as obesity, diabetes, asthma, hypertension, arthritis, ulcer, heart disease, back neck problems, chronic headache, muscle pain. [102,103] Interestingly studies found that depression and anxiety are not commodities with all chronic conditions. The prevalence of anxiety and depression were not found to be increased in cancer patients. [104,105]

Substance Use Disorders are also associated with other chronic conditions in a reciprocal fashion. Individuals with a history of Substance Use have lower perceived health, higher risk of cancer, cardiovascular problems, heart disease and infectious diseases. [106] Substance Use Disorder including opioid addiction are a growing issue with those with chronic pain. [107–110]

2.3.9 Socioeconomic Status

Income is inversely related to depression. Individuals with low income or high financial strain have a much higher prevalence of depression than those with high incomes. [79,87,111,112] There is a gradient of depression with income, in that the prevalence of depression increased with decreased income. This gradient is the steepest from an income level of $10,000 to $30,000 but is still present after this level. [78] Income is associated with depression at individual and area levels. Neighbourhoods that have an average low income have higher rates of depression than those of high income. [113]

Socioeconomic status, in the form of income as well as education and employment status, is similarly related to Anxiety and Substance Use disorder. Individuals with lower education have a higher prevalence of depression [111], and have a higher risk of substance abuse. [47] Lower-income is related to higher Anxiety and Substance Use Disorder at individual and neighbourhood measures. [79,114,115]

However, the pathway which leads to the correlation between mental illness and low socioeconomic status is not universal. There are mixed results of the relationship between Bipolar Disorder and parental SES. Some studies find that the prevalence of Bipolar Disorder is higher among individuals with higher education and whose parents have a higher SES, but this is not consistent across the literature. [116–119]

2.3.10 Other Models

Few Canadian studies examine multiple SDOH when considering mental health outcomes. Those that have found differences in risk factors for Mood and Anxiety Disorders, [120], an association between Bipolar Disorder and younger age and lower-income [121] and between depression and females, lower-income, education, born in Canada, living alone, not married and poor physical health. [122,123] However, there is a lack of studies that used data released after 2002.

2.4 Mental Health Inequality in Canadian Literature

There is a general lack of literature detailing inequalities in mental health in Canada. A few health inequalities papers have been published in academic journals but most of the recent literature in Canada has been released as reports by various regional and national organizations.

2.4.1 A Review of Peer-Reviewed Mental Health Inequality Research

In general, health inequality research in Canada is unsystematically conducted in terms of methods used, indicators studied, and regions evaluated. This is consistent, if not magnified when considering inequalities in mental health. There are few studies that examine mental health inequalities in terms of socioeconomic status, and fewer still that look at mental health as the primary focus. Of the peer-reviewed studies that do examine aspects of mental health inequalities in Canada, the majority were conducted at the city level:

In Vancouver, Chen et al[124] studied the way that biology aligns with social settings. They examined cortisol levels of 54 children over a two year period and found that children from families with fewer savings or that rented versus owned their home had significantly increased cortisol output compared to children from higher socioeconomic status over the study period. They proposed that one reason for this marked increase is that socioeconomic status shaped the way that children perceive and interpret circumstances in their world.

Dunn & Hayes [125] sent an in-depth survey to two neighbourhoods in Vancouver. The survey provided information about housing and health outcomes, including self-rated mental health and wellbeing. They found significant relationships between the majority of explanatory material and conceptual aspects of the lifestyle and neighbourhood in which the individuals lived and their mental health (examples childcare, dwelling type, traffic and marital status). In further analysis, using logistic regression with multiple explanatory variables, the authors found mixed results between income, education and employment and mental health, but indicate that the model fits the data poorly. The authors suggest that a combination of stressors, support, life events, and coping skills all affect mental health.

Lemstra et al [126] examined groups of high, low and average income neighbourhoods in Saskatoon. Among other variables, they compared the rate of mental health disorders in the neighbourhoods using rate ratio estimates. They found that individuals living in the poorest neighbourhoods were 1.85 times more likely to experience mental health disorders compared to the rest of Saskatoon, and 4.27 times more likely to experience mental health disorders than the most wealthy neighbourhoods. They also found that individuals living in low-income neighbourhoods were 1.21 times more likely to fill prescriptions for mental health disorders than the rest of Saskatoon and 1.61 times more likely than the most wealthy neighbourhoods

Steele et al [127] used out-patient billing claims and neighbourhood socioeconomic status to compare mental health visits across enumeration areas in central southern Toronto. Using the percentage of individuals living in neighbourhoods that have a high school diploma, neighbourhoods were divided into quintiles and the rates of the highest and lowest quintile were compared. Individuals living in the highest educated neighbourhoods were 1.6 times more likely to see a psychiatrist. In a later regression analysis, a gradient was present across enumeration

areas, with more claims present for those with living in highly educated neighbourhoods. No difference was found between neighbourhoods and visits to family physicians.

In a second study, Steele et al [128] examined the likelihood of individuals with a 12-month prevalence of anxiety and Depressive Disorders to seek mental healthcare, by education level. Steele found that individuals with a high school diploma were significantly more likely to seek mental health care for a mental health disorder than those with less than high school education.

Finally, Wilson et al [129] examined emotional distress in Hamilton by use of a cross-sectional survey sent to four neighbourhoods. After applying a backward conditional regression model, researchers found that women, smokers, low-income individuals, those new to their neighbourhood, whose home needed repairs or were dissatisfied with their neighbourhood, had a significantly higher odds of reporting emotional distress.

The constant factor found in all peer-reviewed studies was that inequalities are present and always indicate worse prevalence or treatment in areas of greater deprivation. However, the inconsistency of measures used to calculate inequalities, the variety of locations and heterogeneity of mental health-related outcomes makes it difficult, if not impossible to compare inequalities between cities, or in the same city over time.

2.4.2 A Review of Mental Health Inequality Reports

Health Inequality Reports in Canada have been published by a variety of organizations and Health Authorities. In general, reports tell "big picture" stories of inequalities, omitting the details of specific instances of inequalities and at best, merely suggest ideas of causation. New reports are released by different organizations every few years. The most recent health inequality report was released in 2020 by the Urban Public Health Network. [130]

In 2018, The Public Health Agency of Canada (PHAC) released the report titled "Key Health Inequalities in Canada". [131] The report covers a broad array of health indicators, but only 4 pertaining to mental health (suicide mortality, perceived mental health, mental health hospitalization and high alcohol consumption).

PHAC stratified health indicators by 3 socioeconomic indicators: income quintiles as calculated using the low income cut off a measure of adjusted household income, education quintile calculated by the proportion of the population not graduated from high school, and quintiles based on a deprivation index.

The results showed a clear gradient in all measures of SES and suicide mortality; suicide is much more prevalent in areas of lower SES. The rates of suicide mortality were 1.8, 1.6, 1.6 times higher in the poorest, least educated and most deprived neighbourhoods compared to the wealthiest, most educated and least deprived neighbourhoods respectively.

The same inverse relationship was found for perceived mental health and income. The prevalence of good mental health was 4.1 greater in wealthy neighbourhoods than poor neighbourhoods. Good mental health was 2.9 times more prevalent amongst adults who had achieved a high school education and significantly higher in those working in professional occupations.

Mental health hospitalization was 2.2 times more prevalent amongst the poorest neighbourhoods compared to the wealthiest neighbourhoods, and 5.5 times as high in the most deprived areas compared to the least deprived areas.

Interestingly the mixed trend was present in high alcohol consumption. There was a higher proportion of heavy drinking amongst wealthier Canadians, amongst those not in a professional occupation.

In 2015, Toronto Public Health [132] released a report entitled "The Unequal City", an updated version of their 2008 report of the same name. The Unequal city analyzed 34 indicators in relation to income, of which only unhealthy alcohol use was a direct indicator of mental health. Similar to PHAC's report, the TPH concluded that there is a greater rate of unhealthy alcohol use amongst those with higher income.

In 2015 the Canadian Institute for Health Information released its report "Trends in Income-Related Health Inequalities in Canada". [133] Using income quintiles, CIHI analyzed inequalities in 16 health indicators over 10 years, two of which related to mental health (mental illness hospitalization, self-rated mental health). Self-rated mental health was one of only 3 indicators in which inequalities widened over time. The rate of self-rated mental health increased in the poorest 4 quintiles but remained constant in the richest quintile. However, the inequality in Mental Illness Hospitalizations decreased as the rate of hospitalizations increased in the richest quintile.

CIHI's 2008 "Reducing Gaps in Health: A Focus on Socio-Economic Status in Urban Canada" was the first Canadian report to detail health inequalities at a city level. [134] Of the 21 indicators examined over 15 cities, three relate to mental health (health service utilization for Substance-Related Disorders or mental health, and self-reported alcohol binging). Using a deprivation index, CIHI separated the population into low, average and high socioeconomic groups and compared the health outcome in each group.
Individuals in the low socioeconomic status group were 2.3 times more likely to use health services for mental health, 3.4 times more likely to use health services for Substance-Related d\Disorders, and 1.2 times more likely to report alcohol binging than those in the high socioeconomic status group.

Interestingly, this report also allowed for a comparison of indicators between cities. For example, the range of rate ratios between high and low-income groups for Substance-Related Disorders ranged from 2.3 in Toronto to 8.5 in Regina.

Together these articles and reports paint a blurry picture of the state of mental health inequalities but clarify the need for standard reporting, consistent reporting and in-depth analysis.

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3. METHODOLOGY

There are no universally accepted methods to describe health or health inequalities. Therefore this chapter is needed to describe the rationale behind the decisions made in determining the methods for the manuscripts. It begins by describing the methods used to quantify mental health. Next, it explains the methods of health inequalities including the formulas used in the manuscripts. Following inequalities is comments on the chosen datasets, and the chapter ends by outlining the decisions regarding various geographical concepts. Additional information, including the Stata code for each manuscript and CCHS variables, are included in the appendix.

3.1 Mental Health

3.1.2 How Mental Health is Defined in Canada

In Canada mental illnesses are clinically diagnosed using the Diagnostic and Statistical Manual of Mental Disorders (DSM) and the International Classification of Diseases (ICD).

The DSM, published by the American Psychiatric Association, contains descriptions of mental illnesses, symptoms and diagnostic material. It has been updated many times since the first edition was released in 1952. The fifth edition produced using the knowledge of hundreds of scientists, clinicians, and researchers, was released in 2013. [1]

The ICD differs from the DSM in structure and function partially because it is released by the WHO, an international organization, and because it contains codes for all diseases or causes of death that might occur in an individual's life- not just those related to mental health. [2]

Importantly both the DSM and ICD provide a standard language used to record, report and monitor mental illness. [2,3]

Over the last three decades there has been an effort to align the information found in the newest editions of the DSM and ICD. The DSM even contains the corresponding ICD codes that are used for clinical diagnosis. [3,4] This collaboration, as well as advancing medical information, has led to changes in the classification and description of some mental illnesses with the release of new editions.

For the most recent edition of the DSM a few diagnostic criteria changes were made, for example, the criteria for Autism Spectrum Disorder now includes additional behavioural criteria for variants. Importantly for the purposes of this current project, the DSM-5 criteria changed for Substance Use Disorder, Major Depressive Disorder, Bipolar Disorder and Anxiety Disorder.

These changes include:

- The DSM-5 contains criteria for Substance Use Disorder, which was separated into Substance Dependence and Substance Abuse in the DSM-IV.
- Substance Use Disorder is then categorized as mild, or moderate to severe, and contains different ICD codes for both categories.
- The classification of specific anxiety-related disorders was redefined. In the category of Bipolar Disorders, there was an addition of a "with mixed features" specifier which changed the diagnosis of Bipolar I.
- The criteria for Major Depressive Disorder in the DSM-IV contained an exclusion for a two month bereavement period which was removed in the DSM-5. [3,5]

Because of the broad use of the diagnostic material used in the current study, most of the changes found in the DSM-5 will not directly impact the results of this study. However, it is worth noting that studies have found differences in the association of SES with mental health illnesses are dependent on the criteria used to diagnose the illness. [6]

2.3.2 DSM Mental Health Classification System

In the DSM-5 and the ICD-10 mental health disorders are arranged in a simple hierarchical structure. Each chapter of the DSM describes a category of disorder, which is arranged close to similar disorders, and contains criteria for each specific disorder within the category, and sometimes, specifiers within the disorder. For example, ICD-10 code F40.248 is for a "Situational Phobia". This is contained in the "Anxiety Disorders" chapter of the DSM-5 within the Specific Phobias Disorder, under the specification "situational". [4]

The classification system has also undergone some changes from the fourth (published in 1994) to the fifth version (published in 2013) of the DSM. Notable for the purposes of this project is the relationship between Bipolar Disorder and Depressive Disorders. In the DSM-IV both disorders were contained in one chapter under the title "Mood Disorders". In the DSM-5 the Mood Disorder chapter is separated into "Bipolar and Related Disorders" and "Depressive Disorders." The term 'Mood Disorder' does not appear in the DSM-5. [4,7]

2.3.3 Mental Health in the Candian Community Health Survey

In the Canadian Community Health Survey mental health disorders are determined using a modified version of the World Health Organization's Composite International Diagnostic Interview tool (WHO-CIDI). [8] The WHO-CIDI is "a fully structured non-clinical interview designed for use in general population surveys." [9] It uses the definitions and criteria of mental disorders outlined in the DSM-IV and the ICD-10. [8,9] The validity of the WHO-CIDI has been established and it is considered a good measure of mental disorders. [10]

Note: As the classification and definitions of certain mental disorders have officially changed according to the DSM from the time data collection for this study began in 2001, the study will use the definitions of mental health disorders provided by the CCHS, which stay consistent throughout the time collected. The hierarchical classification system used to compare these variables is outdated, but the information presented in the variables is still valuable.

3.2 Health Inequalities

3.2.1 Socioeconomic Status

Socioeconomic status is a broad term used in sociology, economy and other related fields to describe an individual or groups' social standing or place in a social hierarchy. [11–13] It is an abstract concept that cannot be quantitatively measured but is often estimated using income, education, and employment.

It is often estimated in the form of a deprivation index that attempts to quantify social standing on the basis of a combination of variables. Canada's most popular deprivation index, developed by Robert Pampalon, uses six variables: the proportion of people aged 15 years and older with no high school diploma, the population/employment ratio of people aged 15 years and older, the average income of people aged 15 years and older, the proportion of individuals aged 15 years and older living alone, the proportion of individuals aged 15 years and older whose marital status is either separated, divorced, or widowed, and the proportion of single-parent families. [14] While importantly recognizing that SES is a multifaceted variable, deprivation indices, are relatively complicated measures of SES. When using a specific data set, it is not always the case that all the variables to make up the index are present. The combination of

multiple variables and mathematical manipulation to produce the index also makes the meaning of measures of deprivation less intrinsically clear. These factors add a layer of complexity to the dissemination of results calculated with a deprivation index.

Additionally, deprivation indexes are created to measure deprivation in a specific area and are not always generalizable to other areas. Pampalon's measure is used in Quebec, and differs from measures such as the Vancouver Area Deprivation Index or the Townsend Deprivation Index. [14–17] A deprivation index that effectively describes the nation has not been agreed upon in Canada.

Due to these implications of deprivation indexes this study will use a single measure to quantify SES. Commonly income level, education and occupation are used to study SES, and all three are used in studies based in Canada. [18–21] However, income is the most widely used as well as being the only variable that is reported as a continuous rather than categorical variable which can add to its specificity. Income will, therefore, be used as a proxy for SES.

SES can be defined at an individual or area level. However, neighbourhood factors contribute to the social component of SES and that it is standard practice to measure SES at an area level in Canada. Therefore, SES will be calculated at the neighbourhood level.

Income is used as a proxy for socioeconomic status. In this study socioeconomic status is related to mental health because factors that are associated with income, such as the ability to afford medical support, economic stress, or ability to purchase healthy living supplies. In this perspective, income needs to be a measure, not the hourly wage of an individual, instead of as a proxy for how much of that income an individual is able to spend. This quantity differs from the amount of income an individual makes due to a variety of factors, but including the basic concepts of how much tax a person is required to pay, and how many people the income is shared with. For example, a single person living alone with a $50,000 income would be considered to have more money to spend than a married individual supporting a spouse and children making the same amount.

In order to adjust for this income will be calculated by using the average total adjusted household income recorded in the Canadian Census. Adjusted income will be calculated by the total after-tax income of a household divided by the square root of the number of occupants.

3.2.2 Health Inequality

The WHO defines health inequalities as "differences in health status or in the distribution of health determinants between different population groups" [22] Inequalities are any difference in health status between any two groups of individuals. The determinant, or underlying cause, of inequalities, could be an array of factors: age, gender, ethnicity, race, SES, geographic location, weight, hobbies, ect.

Inequalities are not inherently negative. For example, an inequality in height due to gender is expected. The physiology of males is such that on average, males are taller than females. Similarly, inequality in health due to age, or the unequal distribution of health across the age spectrum of a population, is expected. As the population gets older it is expected that health status declines.

Inequities are a subtype of inequalities. When inequalities are not due to physiological variation or choice but are present because of factors outside of an individual's control, they may be considered inequities. Inequities are inequalities that are avoidable, unnecessary, unfair, and unjust. [22–25] Inequities are therefore a cause for moral concern.

As this report is purely a cross-sectional large population-based epidemiological investigation with little consideration of the pathways that caused inequalities, it is difficult to conclusively name the inequality due to SES as inequities. As such, and due to convention in the public health field, the term inequalities will be used instead of inequities. However, the moral implications of mental health inequalities will not be overlooked.

3.2.3 Measures of Inequality

There are many measures of inequality that examine the distribution of health in a population, but there is no universally accepted best method. [26–28] Authors have examined the various methods to quantify health inequalities, but there is no agreement on which method is superior. Instead, each author summarises a different selection of measures of inequality and recommends a few superior methods based on their own criteria.

As the qualifications of the given method depend on the purpose of the study, it is clearly important to emphasize these in the selection. This study strives to provide information on inequalities by SES at the neighbourhood level, that can be compared between the neighbourhood and over time, and can be used by policymakers. Using these qualifications the methods suggested were examined and the most appropriate method for this study was chosen.

This study will use three measures of inequality: the Disparity Rate Ratio (DRR), Disparity Rate Difference (DRD) and the Concentration Index (CI). The DRR and DRD are similar measures and will be described first, followed by a brief explanation of the CI.

3.2.3.1 Mental Health Prevalence Calculations

Prevalence Ratios were calculated using the following formula where numerator is the number of participants who answered in the affirmative, while denominator denotes the total number of participants who answered the question.

$$Prevalence\ Ratio\ (Rate) = \frac{Numerator}{Denominator}\ x\ 100 \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (3.1)$$

Equation 1: Prevalence Ratio

3.2.3.2 Disparity Rate Ratio and Disparity Rate Difference

The DRR and DRD are relatively computationally simple measures of inequality. Differences and ratios are everyday mathematical concepts that can be easily understood by any population. The DRR and DRD are calculated by separating the population into groups (this study will use quintiles) by socioeconomic status (in this study, by income) and comparing the health status of the first and fifth quintile, which represents the richest and poorest groups of the population.

The DRR is calculated by finding the ratio of the poorest to richest:

$$Disparity\ Rate\ Ratio\ (DRR) = \frac{Rate\ among\ poorest\ (Quintile\ 1)}{Rate\ among\ richest\ (Quintile\ 5)} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (3.2)$$

Equation 2: Disparity Rate Ratio

And the DRD is calculated by finding the difference between the poorest and richest neighbourhoods.

Disparity Rate Difference = Rate among poorest (*Quintile* 1) − *Rate among richest* (*Quintile* 5)
……..……(3.3)

Equation 3: Disparity Rate Difference

The DRR and DRD are measures of association that provide relative (DRR) and absolute(DRD) measures of inequality with respect to SES. Importantly, these measures of association directly involve a measure of SES, which is easily comparable between populations and the result is intuitively interpreted which is beneficial for dissemination.

They are also considered bivariate, in that they take into account two concepts (income and health status). Unlike univariate measures inequality, such as the index of dissimilarity or the Gini Coefficient (a measure borrowed from the economics of how health is unequally distributed across the entire population), the DRR and DRR include SES as well as the distribution of a health outcome in their calculation. [26,27] This enables the direction of inequality to be established; if the population of higher or lower SES exhibits an increase in the health outcome studied but also hints at causality. [29]

The DRR and DRD are also useful for comparisons. When reported together, they can both differentiate between equal inflation of income across a population and changes specific to subgroups within a population. This is especially necessary for comparing between different cities and over time.

3.2.3.3 The Concentration Index

The main drawback of using the DRR and DRD is that they measure the extremes of the population without taking into account the whole population. While this aids in their simplicity in calculation and interpretation, it has the potential to miss telling a large part of the inequality story of a city. For example, these measures would be unable to detect a gradient produced between SES and health or describe a population where the entire population, except for the poorest or richest quintile, had very good or very poor health. As such, the use of these measures does have the potential to miss explaining the health of 60% of the population. In order to have a broader picture of health inequalities, this study will use the Concentration Index in combination with the DRD and DRR measures.

The Concentration Index (CI) was developed in an effort to keep the scope of the Gini Coefficient but add the SES variable. [30] It is an excellent measure of absolute health inequality, though, along with methods such as the Slope and Relative Index of Inequality, is known to be sophisticated. [31] This is not ideal for measures that are to be disseminated to community members and policymakers. [28]

The CI, like the DRR and DRD is a bivariate measure, calculated using the SES of the population as well as the cumulative health. It is calculated by ordering the population by socioeconomic status, then determining the relative proportion of health "owned" by each level of socioeconomic status. If the cumulative SES of a population is plotted on the x-axis, and the cumulative percentage of health is plotted on the y-axis, in a completely equal situation, a 45-degree line, known as the line of perfect equality, would be formed. The concentration curve is plotted using the actual data, and the difference between the two lines is used to calculate the concentration index.

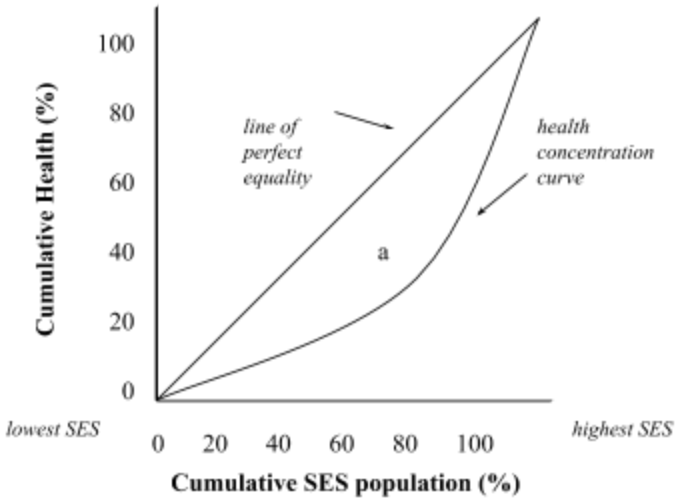

Figure 3.1: The Concentration Index

The formula for the CI is as follows:[32]

$$C(h|y) = \frac{2\,cov\,(hi, Ri)}{\overline{h}} = \frac{1}{n} \sum_{i=l}^{n} \left[\frac{hi}{\overline{h}}(2Ri\right] \quad \text{.....(3.4)}$$

Equation 4: Concentration Index

In this equation *hi* represents the health indicator and *Ri* represents the socioeconomic status rank of the portion of the population. This equation describes the value that is twice the area "a" as depicted in Figure 3.1 where "a" is the area between the concentration curve and a line of perfect equality.

As the CI is a vector, the interpretation of the CI involves considering both the magnitude and the direction of the CI. If the CI is greater than zero, then the greater proportion of health belongs to those with the highest SES, if less than zero, the greatest proportion of health belongs to those of lesser SES. The magnitude of the CI ranges from 0 to 1, with 0 indicating perfect equality, and 1 perfect inequality, where 100% of the health belongs to the richest or poorest of the population.

The Concentration Index, therefore, provides a more holistic picture of health inequalities, yet is more complex in calculation and interpretation.

3.2.3.4 Statistical Significance

Statistical significance was calculated using 95% confidence intervals surrounding the prevalence ratios, disparity rate ratios, disparity rate differences and concentration indexes. Standard Errors of prevalence ratios and concentration index were calculated alongside the values. Standard Error of the prevalence ratios were manipulated to produce standard errors of the DRR and DRD.

$$Standard\ Error = \sqrt{Standard\ Error(Rate_{Quintile\ 1})^2 + Standard\ Error(Rate_{Quintile\ 5})^2} \quad \ldots\ldots(3.5)$$

Equation 5: Standard Error DRD

The test for significance in the comparison of disparity rate ratios was done using a logarithmic scale. Due to the distribution properties of ratios, using a linear calculation, such as a difference calculation would introduce bias to the estimate. Therefore, the proportional test resulting in the calculation of the ratio of the ratios was used.

$$Standard\ Error\left(Log\left(\frac{Rate_{Quintile1}}{Rate_{Quintile5}}\right)\right) = \frac{Standard\ Error(Rate_{Quintile\ 1})^2}{Rate_{Quintile\ 1}^2} + \frac{Standard\ Error(Rate_{Quintile\ 5})^2}{Rate_{Quintile\ 5}^2} \quad \ldots\ldots(3.6)$$

Equation 6: Standard Error DRR

95% Confidence Intervals were produced using the Standard Error and the estimate.

$$95\%\ Confidence\ Interval = Estimate \pm 1.96 \times (Standard\ Error) \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(3.7)$$

Equation 7: 95% Confidence Interval

3.3 Data Source

The Canadian Community Health Survey acts as the main source of data for these studies. The CCHS is a self-reported survey that covers all urban areas in Canada, with the exception of members of the Regular Forces and residents of institutions. The survey provides weights to account for the probability of selection and response [33]. CCHS collects data in two forms: 1) an annual survey that collects similar information from the Canadian population each year and 2) a special topic survey which is administered every 3 years.

The annual health survey has continually been adjusted over the years since its initiation. Originally, data was collected over a 12 month period and released biannually presenting data from 130, 000 respondents. From the 2007 survey onward, the data has been collected continuously and released annually and presents data from 65, 000 respondents. As such, there are three surveys released from 2000-2006, and one survey each year for 2007-2015. The surveys from 2000-2006 have twice the number of observations as single year surveys but lack the chronological specificity of subsequent years. Each of the twelve surveys available from 2000-2015 will be used in the current study.

The focused specific topic survey is collected once every three years over a 12 month period. [34] Each survey presents data from 35,000 respondents. The mental health and well-being portion of the CCHS is used to characterize mental health in Canadians. To date, there have been two specific topic surveys concerning mental health and wellbeing, the first in the 2002-2003 cycle, and the second in the 2012 cycle. However, mental health is a field that is constantly changing. The way the majority of the questions were asked in 2002 are not consistent with the 2012 version, so variables from only the 2012 version will be used in these studies.

The income variable will be taken from the Canadian Census. [35] Income reported in the census is taken from tax information and is more complete than the income variables offered in the CCHS. The Canadian Census is a cross-sectional survey administered every five years, but as

the same questions are asked of Canadians at regular intervals, results can be compared across different censuses spanning a period of many years. Variables from the 2001, the 2006, and the 2011 Canadian Censuses will be used in the current studies.

Note: In 2011, the Government of Canada changed the previously mandatory census to an optional survey. Optional surveys are known to underrepresent those of lowest and highest income groups and those marginalized and immigrant groups. [36]

3.3.1 Data Collection Instruments and variables

These surveys will be used in combination to conduct two related studies.The first study will use prevalence data, as well as DRR, DRD, and CI inequality measures to examine the state of inequalities in mental health in cities over time. These measures, especially the DRR and DRD measures that require the population to be separated into quintiles, require a very large population in order for statistical accuracy. Especially when evaluating an outcome variable that affects less than 10 percent of the population, a single year of the CCHS would not be sufficient. Therefore, for this study, the annual general survey combined over five-year periods that correspond to the available census data will be used. Though this survey covers a much broader range of health-related topics than the special topic surveys administered every 3 years, it importantly asks the same questions consistently, which is essential for comparison.

The second study will use multiple logistic regression on a national scale. As there is much less stratification of the data needed for these calculations, a smaller sample can be used. For this study the more detailed mental health component of the 2012 CCHS will be used.

A list of the specific CCHS questions used and coding decisions used to produce the variables can be found in Appendices B-D.

3.3.2 Considerations for Using Survey Data

The use of secondary data analysis and the use of the CCHS in particular warrants special consideration in a number of areas:

First, the CCHS is a survey completed by an individual based on their own opinions of their current income, living situation and health. Though the questions asked in the CCHS are specific and well researched, questions like “How do you rate your health” are very subjective, and responses will differ for individuals living with similar clinical diagnoses. However, self-reported surveys have been validated numerous times as accurate representations of an individual’s health. [37,38]

The other consideration of optional surveys is that participants can choose to not answer a question. In the CCHS, not answered questions are recorded as missing values. At a macro level, this means that unlike hospitalization data where the population, or denominator when calculating prevalence, can be fixed, in survey data, the denominator is different for every indicator used as a different selection of individuals may have chosen not to answer that question. Special consideration must, therefore, be taken to ensure that the population not answering the question does not differ from the population in general.

The second consideration is the structure of data collection used by Statistics Canada to complete the CCHS. The CCHS is only administered to a subset of Canadians, yet it is meant to portray an accurate representation of the country. In order to compensate for this Statistics Canada uses complex algorithms to oversample certain populations. In this way, one individual

surveyed by Statistics Canada might represent 100 Canadians, while another individual might represent 1000. In order to compensate for this, Statistics Canada releases population weights and bootstrap variables along with the results of the surveys. The weights compensate for unequal sampling while bootstrapping compensated for the lack of independence of variables.

Bootstrapping is a statistical procedure used to calculate the robust standard error (SE) of an estimate where the population is unknown. Bootstrapping is a form of random sampling with replacement, in which the standard error is calculated by taking the standard deviation of the standard error of numerous computations (500 in this study) of the same estimate, but with a smaller, random sample of the population. It is an extensively used and well-documented procedure that is recommended for use by Statistics Canada for these surveys. [39,40]

The final consideration involves the use of the CCHS along with the Canadian Census. The Canadian Census and CCHS are not linked using individual identifiers, instead, they must be linked by geography. The smallest level of geography documented by Statistics Canada is the Dissemination Area (DA), an area of 400-600 people, roughly equivalent to most people's perception of a neighbourhood. Using the postal code from the CCHS, each individual can be assigned a DA using Statistics Canada's Postal Code Conversion File (PCCF+). The implication of using this technique is that as income is drawn from the census which is linked to the CCHS by neighbourhood, income is assigned to an individual as an area-based measure. [41] That is, each individual is assigned an income that is the average income of their neighbourhood, not their individual income.

3.4 Geography

In Canada, health outcomes are impacted by geographical location. Rural and urban differences influence how the social determinants of health are operationalized, physical neighbourhood features impact the perceived health of residents, and the health services, promotions, material and social attributes of cities impact those neighbourhoods.

In general, individuals living in rural areas experience worse physical health, but better mental health than those living in urban areas. [42–45] Improved mental health could be associated with a higher level of community belonging and social support in rural areas. [46] However, individuals living in rural areas often have less access to healthcare, use different healthcare services, have lower socioeconomic status, have a high degree of community adhesion, have higher health risk behaviours and have limited access to jobs. [45] These factors suggest that people living in rural areas experience the social determinants of health in a different way than their urban compatriots.

In general, urban and rural populations tend to have different population demographics with very different lifestyles and living environments. Additionally, the growing majority of Canada's population resides in urban areas; as of the 2016 Canadian census over 81% of Canadians lived in urban areas. [47] As this paper is based on the premise that social determinants of health are largely responsible for the health of a population, including both urban and rural populations in the same analysis, without the primary objective a direct comparison could add many confounding factors to the analysis. That is, urban and rural populations are different enough that in a study involving the comparison of health inequalities by SES, the differences in health outcomes could easily be clouded by the urban/rural difference. As such, this study will exclude the rural population from analysis, and focus on the urban population, particularly those living in metropolitan cities.

The relationship between SES and health has a lot to do with the physical and social environment in which people live, in particular, their neighbourhood. [48,49] The physical aspects of a neighbourhood, like the amount and access to green space, proximity to health services, population, air quality and noise, impact an individual's mental health. [50,51] Neighbourhoods are often more demographically homogeneous, often with high concentrations of people of similar race, ethnicity, and time in Canada. [49,52,53] As neighbourhoods are important parts of a person's lived experience in regards to health, in this study each neighbourhood, instead of individual respondents, will be taken as a single observation.

Cities also have distinct health outcomes. [54] Many health decisions come at the level of the health region and municipality which are commonly the same within cities, but different between cities of the same province. People tend to conceptualize their daily experiences to be more similar to people living in their own city, than those living in a different city. Therefore, this study will use the city as the smallest unit of comparison.

3.4.1 Geographical Coding

In Canada, geographical coding is defined by Statistics Canada. Simply stated, Statistics Canada codes areas based on two criteria:

1) arbitrary municipalities based on historical boundaries
2) and levels of population density.

The dissemination area (DA) is the smallest level of geography coded by Statistics Canada and is also the common building block between the two criteria. Statistics Canada describes DA as "a small, relatively stable geographic unit". Each DA has a population of between 400 and 700 people. [55] DA will be used synonymously with neighbourhood in this study.

As discussed, urban areas behave differently than rural areas, in that health issues, access to health care, and income inequality all take on different meanings in rural rather than in urban areas. This makes including both urban and rural areas, or worse, not considering urban and rural differences, in the discussion of health inequalities in terms of the social determinants of health inappropriate. This could also be argued for the differences of very small to large cities. However, in order to have a meaningful and manageable analysis, cities in this study will be taken as any DA located in a Census Metropolitan Area ("Area consisting of one or more neighbouring municipalities situated around a core. A census metropolitan area must have a total population of at least 100,000 of which 50,000 or more live in the core.") [55] that has an urban population, as defined based on Statistics Canada's second criteria, population density.

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4. TRENDS IN INEQUALITIES IN MENTAL HEALTH DISORDERS IN URBAN CANADIAN PROVINCES AND CITIES

4.1 Abstract

Introduction

Canadians do not all enjoy equal levels of health. The presence of income-related health inequalities have been well established in Canada, but there is a lack of research surrounding consistent reporting and comparison of inequalities in Canada's largest cities, particularly concerning mental health. This study addresses the first step leading to an increasingly equal society; reporting the prevalence and inequalities in mental health outcomes at the city, provincial and national levels over time.

Methods

Self-reported Poor Mental Health (PMH), Life Stress (LS), Mood Disorder (MD), and Anxiety Disorder (AD) were taken from the Canadian Community Health Survey (2001-2015). Outcomes were combined into three 5-year periods and linked to neighbourhood income from the Canadian Census.

Analysis occurred in three parts: First, prevalence rates were established at the neighbourhood to the national level. Second, absolute (Disparity Rate Ratio), relative (Disparity Rate Difference), and overall (Concentration Index) inequalities were calculated at the city, provincial and national levels. Finally, the rates and inequalities were compared between geographies, and within the same geography over time.

Results

At the national level, the prevalence 2011-2015 of PMH (27.9%), MD (7.3%) and AD (6.8%) had all significantly increased from 2001-2005. Relative, absolute and overall inequalities were present in 2001-2005 and were maintained or worsened over time.

Rates for PHM, MD and AD were more extreme in smaller cities, compared to larger cities. There was little consistency of prevalence rates between cities of similar geography or population. Relative, absolute and overall income inequalities were present for nearly all cities. No one city could report a lack of inequality or constantly reported the highest level of inequalities.

There was no income-related health inequality found for Life Stress and the prevalence rate at the national level decreased over the time period studied.

Discussion

The large disparity in results between cities in similar geographical areas and with different measures of mental health highlight the necessity for mental health disorder-specific data and for city-level analysis of inequalities. The next steps in reducing inequalities involve deconstructing the health inequalities, as well as continued monitoring.

4.2 Introduction

Canada is among the healthiest countries in the world, but not all Canadians enjoy the same high levels of health. [1] Health Inequalities are an increasingly studied phenomenon that describes how some populations, due to their biological or socio-demographic characteristics, experience health at higher levels than other populations. [2] Socioeconomic status, often quantified by income, is a common factor that is often used to illustrate the discrepancy in populations' health statuses. It has been indisputably found that health inequalities due to income exist in Canada, that is, poorer populations have worse health outcomes than richer populations. [3–6]

In recent years, Canada has placed a large emphasis on mental health. The government has annually spent billions of dollars on mental health, [7] Public Health campaigns by celebrities, [8] large companies [9] and schools[10] have worked to destigmatize mental health. Even internationally, the newest version of the DSM refined how mental health is clinically understood. [11] However, perhaps due to this increased awareness, changes in diagnostic criteria, or a complex array of other social and environmental factors, PHAC has reported that the rates of Mood and Anxiety Disorders, the most common mental health disorders are remaining constant, affecting 10% of the Canadian population. [12,13]

When evaluating health, studies point towards the lived experience of individuals as a determinant, in particular, the geography of where individuals live. [14–17] That is to say, the social and material aspects that make up an individual's neighbourhood impact an individual's mental health. This suggests that an individual's experience of health due to social and material aspects is likely to be more similar to those who live closest to them. So when comparing health outcomes, individuals should be compared to others with the most similar health environment- their own neighbourhood. It also points to the city as an important unit of analysis when discussing health inequities.

More broadly, this also suggests an issue of comparing rural and urban health outcomes. Due to a variety of factors including differences in age, working opportunities, access to healthcare, and demographics, [18] the lived experience affecting the health of rural and urban population differs to an extent that could obfuscate comparisons of geographies that include both urban and rural populations. The growing majority of Canadians live in urban areas, [19] so this paper chooses to focus on urban areas, accepting that rural health is an important topic that needs to be separately evaluated.

Taken together, studies have found that health inequalities in Canada are present, though not consistently reported, rates of mental health are increasing and an individual's environment impacts their health. This points to a need to examine inequalities in the maintained prevalence of mental health, particularly in urban areas.

To date, there have been few studies that examine mental health inequalities in terms of income in urban Canada. [16,20–23] These studies have used a variety of methods to quantify inequalities which make a comparison between cities or analysis over time difficult. Only one study chose to report inequalities by neighbourhood income. Lemstra et al found that poor neighbourhoods were 4.27 times more likely to report mental health disorders than the wealthiest neighbourhoods. Therefore, by reporting the prevalence rates and measures of inequality in 33

large cities across Canada over a period of fifteen years, this study seeks to answer the questions: "How does the prevalence of mental health indicators differ in cities and provinces in urban Canada?" and "How are inequalities in mental health changing in urban Canada?"

4.3 Methods

4.3.1 Study Design

The study design is a secondary data analysis of a national cross-sectional survey, the Canadian Community Health Survey.

4.3.2 Data Source

Data for this study were collected from two sources maintained by Statistics Canada- Canadian Community Health Survey (CCHS) and the Canadian Census of Population (Census).

Individual-level health data was collected from the CCHS. The CCHS is a national cross-sectional survey administered annually to a representative sample of Canadians over the age of 12. Detailed sampling methods are discussed elsewhere. [24] Briefly, the CCHS was first administered in 2000 and covers the population aged 12 and over living in one of the 10 Canadian provinces excluding those living on reserves and other Aboriginal settlements, full-time members of the Canadian Forces, and residents of institutions. Together, these exclusions make up about 3% of the Canadian population. The CCHS annual surveys from 2001 to 2015 were used.

Neighbourhood level income data was collected from the Census. The Census is a mandatory survey completed by every Canadian dwelling, collecting information on the population of Canada every five years. [25]The Candian Census in 2001, 2006 and 2011 were used.

4.3.3 Study Size

The CCHS selected approximately 130,000 individuals for each biannually reported survey (2001, 2003, 2005), and 65,000 for each annually reported survey (2007-2015). Over the 15 year study period, a total of approximately 975,000 responses were collected.

This sample was restricted to include only residents of urban metropolitan cities.

4.3.4 Setting

Urbanity was determined if participants resided in a Dissemination Area in one of Canada's Census Metropolitan Areas (CMA) that had a population density of above 400 persons per square km and a total population over 1000. [26] A CMA is defined as a collection of municipalities situated around a core that has a population of at least 100,000 people. [27] In total, 33 CMAs met these criteria, representing 9 of Canada's provinces.

4.3.5 Variables

4.3.5.1 Mental Health Outcome Variables

Four dichotomous mental health outcome variables were selected from the CCHS: Poor Mental Health, Life Stress, Mood Disorder and Anxiety Disorder. Respondents were classified as having **Poor Mental Health (PMH)** if they, on a five-category scale, did not report having excellent or very good mental health. Respondents were classified as having **Life Stress (LS)** if they reported

that they, on a five-category scale, found most days quite a bit or extremely stressful. Respondents were classified as having a **Mood Disorder (MD)** if they reported having a MDr such as Depression, Bipolar Disorder, Mania or Dysthymia (yes vs no). Respondents were classified as having an **Anxiety Disorder (AD)** if they reported having an AD such as a phobia, Obsessive-Compulsive Disorder or a Panic Disorder (yes vs no).

4.3.5.2 Income Variable

Adjusted average neighbourhood income was calculated using the after-tax income variable from the Census. Total household income was adjusted by the square root of the number of people living in the household. Neighbourhood income was then calculated as the average adjusted household income in each Dissemination Area (DA).

4.3.6 Data Analysis

Data analysis occurred in a stepwise fashion.

First, CCHS surveys were combined into three large datasets in five-year increments (2001-2005, 2006-2010, 2011-2015) in order to align with the 2001, 2006 and 2011 Census. Data were then re-coded so each of the outcome variables was in dichotomous form. Each respondent was assigned to a DA using the PCCF+ provided by Statistics Canada. Three versions of the PCCF+ were used.

Then, income quintiles were established using the average adjusted neighbourhood income variable from the Census, at the CMA level.

Income quintiles were then linked by DA to the CCHS data. The prevalence of each mental health outcome was calculated for each quintile of each CMA.

Next, measures of inequality were determined using three calculations, the Disparity Rate Ratio (DRR), Disparity Rate Difference (DRD) and the Concentration Index(CI). Bootstrapping techniques were used to develop robust standard errors.

Finally, comparisons using 2-tailed t-tests were made between prevalence rates and measures of inequality between cities, provinces, and over time within the same geography.

All data analysis was conducted using Stata 14 software (StataCorp. 2015. Stata Statistical Software: Release 14. College Station, TX: StataCorp LP.) available within the Saskatchewan Research Data Centre (SKY-RDC).

Ethics approval was exempt from the University of Saskatchewan Behavioural Research Ethics Board.

4.4 Results

4.4.1 Prevalence of Mental Health Indicators in 2011-2015

The overall rates of each indicator at the national, provincial and city-level from 2011-2015 can be found in Table 4.1. At the national level, 27.9% of urban Canadians reported PMH, 65.5% reported living with LS, 7.3% reported living with an MD and 6.8% reported living with an AD.

At the provincial level, the highest rates of MD and AD were concentrated in the maritime provinces, while the highest rates of PHM were found across the country in New Brunswick, Manitoba and British Columbia. Only Quebec (66.7%) reported a prevalence of LS that was significantly above the national average (65.5%)

Table 4.1: Overall Prevalence of Mental Health Indicators in 2011-2015

	Mental Health Outcome Prevalence (Percent of Population)			
	Poor Mental Health	Life Stress	Mood Disorder	Anxiety Disorder
Canada	**27.9**	**65.5**	**7.3**	**6.8**
Province				
British Columbia	32.0	63.4	8.4	6.5
Alberta	26.2	65.8	7.4	6.2
Saskatchewan	29.3	64.6	8.5	6.9
Manitoba	30.6	63.8	8.1	7.2
Ontario	28.2	65.8	7.9	7.2
Quebec	25.4	66.7	5.0	5.9
New Brunswick	31.6	62.4	10.6	10.7
Nova Scotia	27.6	64.1	10.6	10.5
Newfoundland and Labrador	24.8	61.3	8.9	10.5
City				
Victoria	28.5	61.1	10.9	7.7
Vancouver	32.2	63.8	7.9	6.1
Abbotsford - Mission	34.4	64.6	9.5	7.0
Kelowna	34.6	60.0	11.5	9.4
Calgary	25.1	65.4	6.8	5.6
Edmonton	27.3	66.3	8.1	7.1
Saskatoon	28.3	63.1	8.2	7.1
Regina	30.6	66.4	8.9	6.5
Winnipeg	30.6	63.8	8.1	7.2
Thunder Bay	35.1	62.6	10.0	8.2
Greater Sudbury / Grand Sudbu	29.4	62.3	9.8	11.3
Barrie	28.5	70.4	11.8	10.4
Windsor	25.6	62.9	8.3	7.6
London	29.4	65.6	10.6	8.7
Guelph	30.1	67.0	13.1	10.1
Brantford	32.7	67.3	10.6	9.3
Kitchener - Cambridge - Waterl	29.4	68.1	10.5	9.6
St. Catharines - Niagara	26.4	61.7	9.5	10.8
Hamilton	27.0	63.3	9.6	9.1
Toronto	27.8	66.4	6.2	5.6
Oshawa	27.8	68.2	12.6	9.2
Peterborough	33.2	62.3	12.1	12.4
Kingston	33.3	66.9	12.0	12.8
Ottawa-Gatineau	28.6	65.0	8.9	8.3
Montreal	26.0	68.0	5.0	5.6
Trois-Rivires	29.3	61.8	5.2	6.9
Sherbrooke	23.7	65.0	4.5	8.0
Quebec	22.7	62.5	4.2	6.3
Saguenay	23.2	61.5	5.6	6.5
Saint John	30.3	62.4	11.0	9.6
Moncton	33.4	63.6	10.6	12.2
Halifax	27.6	64.1	10.6	10.5
St. Johns	24.8	61.3	8.9	10.5

Note: Statistical test, indicated by colour, compares each city or province and overall Canada estimate; $p < .05$ (two-tailed tests). Red indicates a statistically higher prevalence rate than the overall estimate, greeen indicates a statistically lower prevalence rate than the overall estimate, and black indicates no statistical differnce from the overall estimate.

Overall the prevalence rate amongst cities was more varied than among provinces. For example, the prevalence rate of LS varied from 61.3% (Newfoundland and Labrador) to 66.7% (Quebec) among provinces but had a much greater range, from 60.0% (Kelowna) to 70.4% (Barrie) in cities.

At the city level, smaller cities had more extreme prevalence rates than large cities. Smaller cities such as Guelph, Brantford, Kitchener-Cambridge-Waterloo, and Kingston all had significantly higher rates than the national average across the indicators, while Canada's three largest cities, Toronto, Montreal and Vancouver were only slightly different than the national average in any of the indicators.

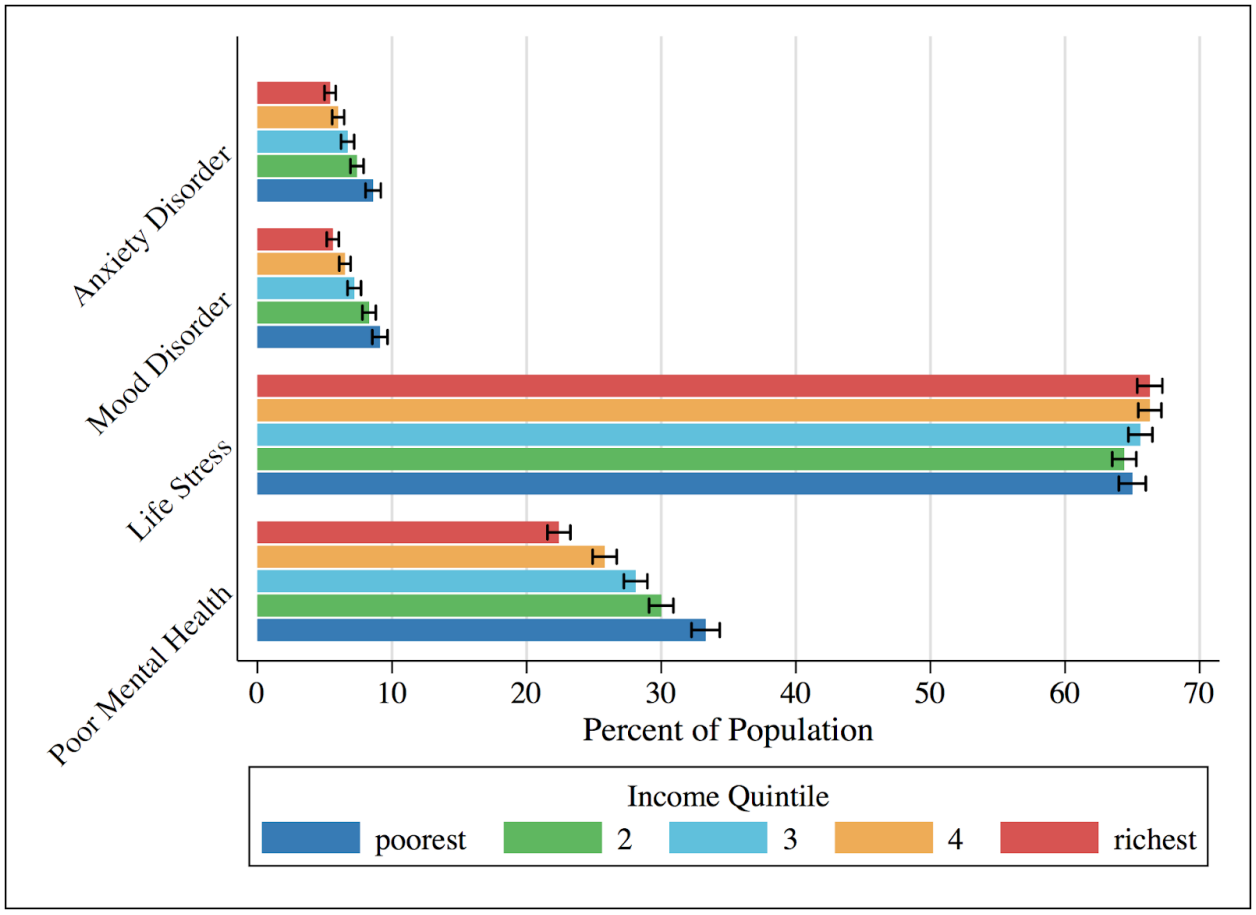
Also of note, Quebec was the only city with prevalence rates below the national average in all four indicators.

There was little geographical consistency for the prevalence of mental health indicators in cities within the same province, in that cities located in the same province did not have a more similar prevalence of mental health indicators than those from different provinces. For example, Toronto had a more similar prevalence of MD and AD to Abbotsford than to Hamilton, even though Toronto and Hamilton are much closer geographically than Toronto and Abbotsford.

Finally, there was a high level of correlation between AD and MD (0.74), a moderate between self-reported mental health and MD and AD (0.58, and 0.30, respectively, but little correlation between LS and any of the other three indicators.

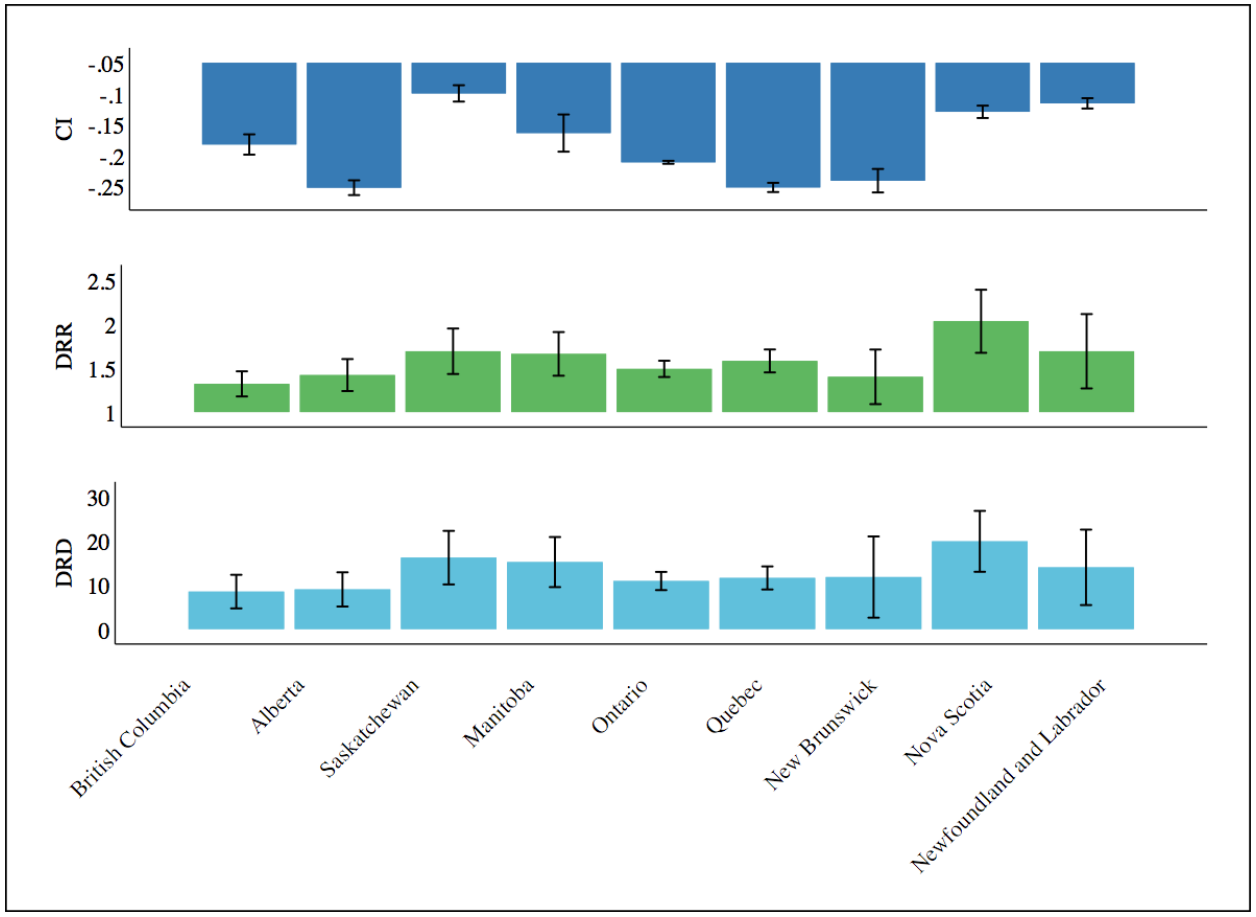
4.4.2 Inequalities of Mental Health in 2011-2015

Inequalities were calculated by the concentration index and by comparing levels of health in the poorest and richest neighbourhoods. Graph 4.1 shows the distribution of mental health outcomes by income quintile at the national level. For AD, MD and PMH there is a clear graded increase of mental health outcomes with decreased income. There is no significant difference in rates between the richest and poorest quintiles for LS.



Graph 4.1: Prevalence Rate of Mental Health Outcomes Among Income Quintiles

Inequality in mental health exists at every level in Canada. This is illustrated in Graph 4.2, which shows an overview of inequality in PMH in Candian Provinces. The negative CI, DRR of over 1, and positive DRD indicate inequality with worse mental health in the poorer neighbourhoods. Higher rates of PMH are consistently concentrated in poor neighbourhoods at varying levels, across the country.



Graph 4.2: Measures of Inequality of Poor Mental Health in Urban Canadian Provinces (2011-2015)

Table 4.2, provides the CI, DRD and DRD measures of inequality for the national, provincial and city levels in Canada. As seen in the CI columns, inequalities are present at varying levels in all four indicators of mental health. The CI is the smallest for LS, and the largest for MD and AD at the national, provincial and city levels. The highest level of inequality is seen in MD(-0.340) and AD (-0.353), followed by PMH (-0.219), then a small inequality of LS with (-0.063). These overall findings translate to relative and absolute measures. 1.49 times as many people in the poorest neighbourhoods reported having PMH than those in the richest neighbourhood, this represents 10.9% more of the population reported having poor mental health in the poorest neighbourhood as compared to the richest neighbourhoods. The same trend was true of AD and MD (DRR 1.59, 1.62, DRD 3.2% 3.5%, respectively). However, this was not seen for LS, there was no statistically significant difference between the richest and poorest quintile in 2011.

Table 4.2: Overall Prevalence of Mental Health Indicators in 2011-2015

	Concentation Index				Disparity Rate Ratio				Disparity Rate Difference			
	PMH	LS	MD	AD	PMH	LS	MD	AD	PMH	LS	MD	AD
Canada	-0.219	-0.063	-0.340	-0.353	1.49	0.98	1.62	1.59	10.9	-1.3	3.5	3.2
Province												
British Columbia	-0.182	-0.073	-0.305	-0.266	1.32	0.99	1.35	1.41	8.5	-0.4	2.5	2.2
Alberta	-0.252	-0.083	-0.394	-0.394	1.42	0.98	1.52	1.59	9.0	-1.2	3.2	3.0
Saskatchewan	-0.099	-0.020	-0.370	-0.086	1.69	0.95	1.67	1.83	16.2	-3.7	4.8	4.9
Manitoba	-0.164	-0.058	0.001	-0.192	1.66	0.93	1.43	1.60	15.2	-4.5	2.9	3.6
Ontario	-0.211	-0.065	-0.335	-0.336	1.49	1.00	1.65	1.61	10.9	-0.2	3.9	3.4
Quebec	-0.252	-0.042	-0.396	-0.435	1.58	0.94	2.00	1.63	11.6	-4.2	3.1	2.9
New Brunswick	-0.241	-0.069	-0.183	-0.227	1.40	0.99	1.87	1.75	11.8	-0.7	7.4	6.5
Nova Scotia	-0.129	-0.059	-0.143	-0.402	2.03	1.07	1.57	1.96	19.9	4.8	4.8	7.1
Newfoundland and Labrador	-0.116	-0.075	-0.502	-0.343	1.69	1.07	1.46	1.56	14.0	4.1	3.6	5.0
City												
Victoria	-0.210	-0.071	-0.281	-0.255	1.57	1.17	1.70	3.00	12.5	9.1	4.5	6.2
Vancouver	-0.179	-0.083	-0.311	-0.305	1.28	0.97	1.30	1.21	7.6	-1.7	2.1	1.2
Abbotsford - Mission	-0.028	-0.047	-0.145	0.049	1.33	0.93	1.48	1.36	9.9	-4.8	3.8	2.2
Kelowna	-0.195	-0.054	-0.218	-0.174	1.66	1.07	1.54	3.03	15.4	4.3	4.6	13.2
Calgary	-0.232	-0.078	-0.330	-0.345	1.36	0.96	1.62	1.73	7.8	-2.9	3.5	3.0
Edmonton	-0.273	-0.087	-0.456	-0.430	1.49	1.01	1.39	1.48	10.3	0.6	2.7	3.0
Saskatoon	-0.065	-0.010	-0.368	0.034	1.71	0.97	2.12	1.93	16.6	-2.1	6.5	5.6
Regina	-0.076	-0.024	-0.115	-0.080	1.66	0.92	1.27	1.68	15.8	-6.0	2.5	3.9
Winnipeg	-0.164	-0.058	0.001	-0.192	1.66	0.93	1.43	1.60	15.2	-4.5	2.9	3.6
Thunder Bay	-0.035	-0.020	-0.282	-0.173	1.26	1.05	2.47	1.87	7.9	2.8	9.1	4.6
Greater Sudbury / Grand Sudbu	-0.105	0.009	-0.033	0.245	1.51	0.97	1.57	1.47	12.2	-1.7	4.2	4.9
Barrie	-0.208	-0.043	-0.389	-0.282	1.02	0.94	1.46	1.42	0.6	-4.7	5.2	3.9
Windsor	-0.050	0.003	-0.013	0.006	1.36	1.00	2.29	2.04	7.6	-0.2	5.4	4.7
London	-0.199	-0.063	-0.321	-0.207	1.88	1.06	2.34	2.31	19.3	4.1	8.3	7.1
Guelph	-0.151	-0.066	-0.131	-0.101	1.77	1.10	2.01	2.55	16.8	6.2	9.1	8.2
Brantford	-0.186	-0.032	-0.268	-0.151	2.05	1.09	2.12	1.33	20.7	5.6	8.3	3.4
Kitchener - Cambridge - Waterl	-0.173	-0.043	-0.256	-0.163	1.66	1.00	1.64	1.08	14.8	0.1	6.1	0.9
St. Catharines - Niagara	-0.235	0.007	-0.294	-0.131	1.32	0.97	1.45	1.74	7.7	-1.7	3.9	5.8
Hamilton	-0.257	-0.043	-0.350	-0.426	1.58	1.02	2.15	1.80	13.2	1.3	8.6	5.9
Toronto	-0.233	-0.077	-0.393	-0.419	1.45	0.97	1.55	1.48	9.8	-1.7	2.6	2.2
Oshawa	-0.203	-0.056	-0.240	-0.251	1.84	1.08	1.61	1.79	16.9	5.7	6.4	5.8
Peterborough	-0.078	-0.069	-0.021	-0.111	1.77	1.16	2.08	1.77	19.2	9.3	7.9	7.6
Kingston	-0.096	-0.060	-0.015	-0.193	1.07	1.04	1.57	2.62	2.5	2.6	5.2	11.5
Ottawa-Gatineau	-0.184	-0.045	-0.340	-0.310	1.52	1.02	1.43	2.19	11.9	1.5	3.2	5.6
Montreal	-0.248	-0.044	-0.407	-0.437	1.56	0.94	1.89	1.44	11.5	-4.0	2.5	2.0
Trois-Rivires	-0.382	-0.102	0.009	-0.473	1.47	0.86	1.49	2.06	11.0	-9.5	2.6	5.4
Sherbrooke	-0.186	-0.054	-0.565	-0.507	1.47	1.01	1.69	0.96	9.3	0.8	2.9	-0.4
Quebec	-0.294	-0.074	-0.362	-0.377	1.78	0.91	2.45	2.68	13.5	-5.9	4.2	6.2
Saguenay	-0.276	0.030	-0.066	-0.438	1.86	1.19	1.98	1.56	13.1	10.5	4.3	3.1
Saint John	-0.169	-0.023	0.210	0.005	1.41	1.22	1.24	2.43	10.8	12.5	2.2	6.7
Moncton	-0.250	-0.073	-0.245	-0.078	1.33	0.80	2.55	1.33	11.2	-14.7	11.9	4.5
Halifax	-0.129	-0.059	-0.143	-0.402	2.03	1.07	1.57	1.96	19.9	4.8	4.8	7.1
St. Johns	-0.116	-0.075	-0.502	-0.343	1.69	1.07	1.46	1.56	14.0	4.1	3.6	5.0

Note: Statistical test compares each city or province and overall estimates; colours indicate a statistical differnce compared to the combined estimate, $p < .05$ (two-tailed tests). Red indicates a statistically higher prevalence rate than the overall estimate, greeen indicates a statistically lower prevalence rate than the overall estimate, and black indicates no statistical differnce from the overall estimate.

There is little consistency among cities and provinces in the magnitude of inequality. No one city or province has extremely low or high levels of inequality. In general, the larger cities and provinces tend to have smaller levels of absolute and relative levels of inequality, compared to smaller cities that have a much higher range. For example, in Vancouver in 2011, the DRR for the four indicators ranged from 0.97 to 1.30, while in Victoria, the DRD ranged from 1.17 to 3.00. Similarly, for DRD in provinces in 2011, Quebec had an absolute range of 2.9 to 11.6, while Nova Scotia ranged from 4.8 to 19.9. This trend did not hold true with the Concentration Index. Out of all the provinces, only Manitoba, which is a mid-sized province, boasted having a lower than national average CI across all four mental health indicators. Little consistency was found in the CI among cities.

4.4.3 Prevalence of Mental Health Indicators over time

Table 4.3 describes the prevalence rate of mental health indicators for each mental health indicator with slanted arrows indicating a statistically significant change between time periods (2001-2005 to 2006-2010 and 2006-2010 to 2011-2015), and vertical arrows describing the change from first to last time period (2001-2005 to 2006-2010).[1]

Table 4.3: Change in Rates of Mental Health Indicators over time in Urban Canada

	Prevalence Rate 2001 - 2005	Δ	Prevalence Rate 2006 - 2010	Δ	Prevalence Rate 2011 - 2015	Δ
Poor Mental Health	25.8		25.3	↗	27.9	↑
Life Stress	66.6	↘	65.5		65.5	↓
Mood Disorder	5.3	↗	6.4	↗	7.3	↑
Anxiety Disorder	4.1	↗	5.2	↗	6.8	↑

Note: Slanted arrows indicate a statistical change between the 5 year time periors adjacent to the arrow. Vertical arrows indicate a statistically significant overall change from the 2001 - 2006 period to the 2010 - 2015 period $p < .05$; (two-tailed tests)

At a national level, PMH, MD and AD all increased steadily from the first measure in 2001-2005 to 2006-2010 (exception of no change in PMH form 2001-2005 to 2006-2010). The national prevalence rate of LS decreased from the 2001-2005 to 2006-2010 period and remained constant from 2006-2010 to 2011-2015.

Every province showed an increase in MD and AD from the first to last time period. The majority of cities showed an overall increase in MD and AD, not one city reported a decrease in the prevalence rate of either MD or AD.

Two cities (Toronto and Thunder Bay) reported a decrease in PMH from 2001-2005 to 2006-2010, but a larger increase from 2006-2010 to 2011-2015 for an overall increase. Though not all provinces reported a statistically significant increase, the prevalence rates of all provinces and many cities increased from 2001-2005 to 2011-2015.

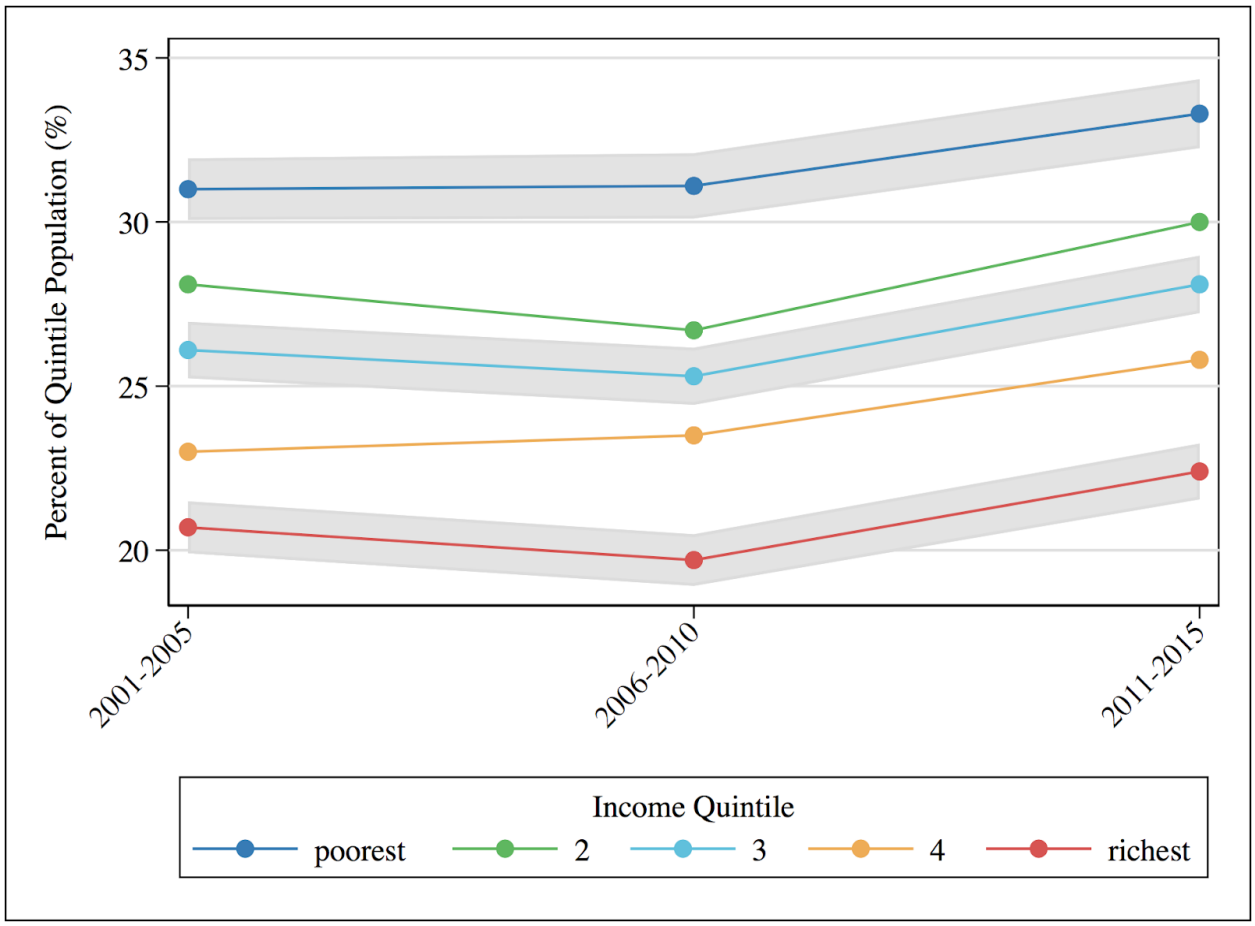
In terms of LS, Montreal was notable in that it was the only city to show an increase in the prevalence rate. Though the national prevalence rate decreased from 2001-2005 to

[1] The change in prevalence rates for each province and city over time is found in Appendix G.

2011-2015, only three provinces (Saskatchewan, Manitoba, and Ontario) reported an overall decrease in the prevalence rate. The majority of the change occurred from 2001-2006 to 2006-2010, only one city changed significantly from 2006-2010 to 2011-2015.
The prevalence rate of LS increased from 62.5% in 2006-2010 to 66.4% in 2011-2015.

4.4.4 Trends in the prevalence of Mental Health Indicators over time

Graph 4.3 - 4.6 illustrate the prevalence rates of each mental health indicator separated by income quintile at the national level. While Tables 4.4-4.7 provide the changes in measures of mental health inequality at the national, provincial and city level.



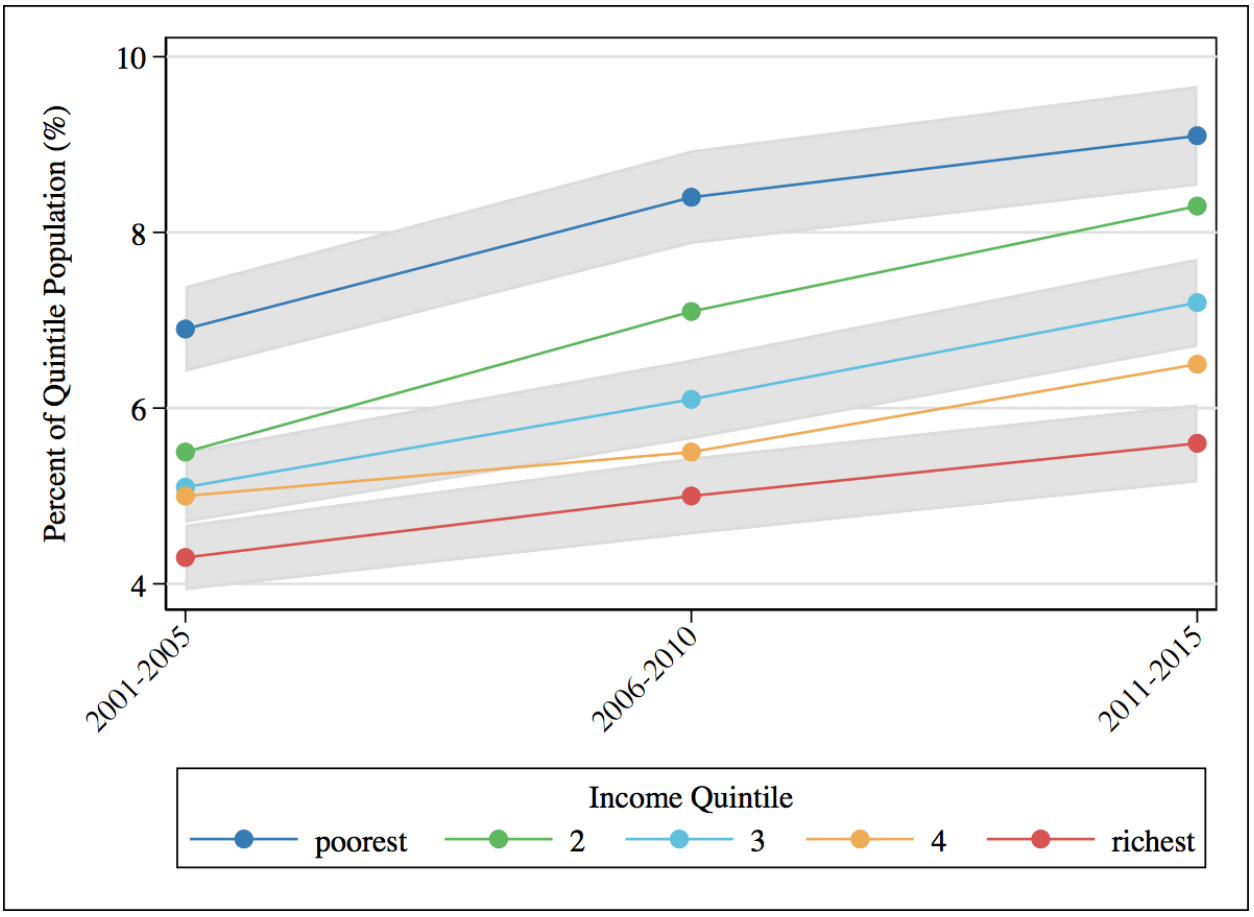
Graph 4.3: Prevalence Rate of Poor Mental Health Among Income Quintiles Over Time

Table 4.4: Change in Measures of Poor Mental Health Inequality Over Time in Urban Canada

	2001 - 2005 to 2006 - 2010			2006 - 2010 to 2011 - 2015			2001 - 2005 to 2011 - 2015		
	CI	DRR	DRD	CI	DRR	DRD	CI	DRR	DRD
Canada	-0.023	1.05	1.1	-0.076	0.94	-0.5	-0.099	0.99	0.6
Province									
British Columbia	-0.038	0.85	-5	-0.048	0.94	-0.6	-0.086	0.80	-5.6
Alberta	-0.02	0.73	-7.2	-0.095	1.04	1.2	-0.116	0.77	-6
Saskatchewan	-0.022	0.81	-3.1	0.004	0.99	1.6	-0.017	0.80	-1.5
Manitoba	0.038	1.07	4	-0.111	0.89	-2.6	-0.073	0.96	1.4
Ontario	-0.01	1.13	3	-0.07	0.93	-1.1	-0.08	1.06	1.9
Quebec	-0.052	1.18	2.9	-0.07	0.95	0.5	-0.122	1.12	3.4
New Brunswick	0.025	1.07	-1.4	-0.163	0.76	-4.8	-0.138	0.81	-6.2
Nova Scotia	0.027	2.04	13.4	-0.028	0.68	-2.9	-0.001	1.38	10.5
Newfoundland and Labrador	-0.084	1.54	9.1	0.025	0.97	2.5	-0.059	1.50	11.6
City									
Victoria	-0.039	0.87	-3.8	-0.087	1.14	4.4	-0.126	0.99	0.6
Vancouver	-0.061	0.82	-6.1	-0.015	0.91	-1.8	-0.077	0.74	-7.9
Abbotsford - Mission	-0.035	1.44	11	0.028	0.99	0.7	-0.007	1.41	11.7
Kelowna				-0.107	1.29	8.5			
Calgary	-0.004	0.59	-11	-0.076	1.08	1.9	-0.08	0.64	-9.1
Edmonton	-0.037	0.90	-3.4	-0.117	1.01	0.7	-0.154	0.91	-2.7
Saskatoon	-0.003	0.88	-1.3	0.05	1.04	1.8	0.047	0.91	0.5
Regina	-0.016	0.77	-4	-0.012	0.92	0.7	-0.028	0.71	-3.3
Winnipeg	0.038	1.07	4	-0.111	0.89	-2.6	-0.073	0.96	1.4
Thunder Bay	-0.254	1.14	0.6	0.242	0.73	-7.4	-0.012	0.83	-6.8
Greater Sudbury / Grand Sudbury	0.011	0.97	2.6	-0.062	0.90	-2	-0.051	0.88	0.6
Barrie				-0.129	0.82	-5			
Windsor	-0.061	0.58	-13.6	0.111	1.12	2.5	0.05	0.64	-11.1
London	0.049	1.10	3.7	-0.129	1.43	11.5	-0.08	1.58	15.2
Guelph				-0.094	1.01	1			
Brantford				-0.121	1.26	5.6			
Kitchener - Cambridge - Waterloo	-0.094	0.98	0.3	0.021	1.07	3.2	-0.073	1.05	3.5
St. Catharines - Niagara	-0.036	1.23	4.6	-0.121	0.88	-2.7	-0.157	1.08	1.9
Hamilton	-0.038	1.41	7.7	-0.092	0.64	-8.6	-0.131	0.91	-0.9
Toronto	-0.005	1.20	4.1	-0.057	0.91	-1.9	-0.062	1.09	2.2
Oshawa	-0.089	1.02	0.7	-0.031	1.16	5	-0.12	1.19	5.7
Peterborough				-0.019	2.57	31.2			
Kingston	0.028	0.83	-4.7	-0.082	0.96	-0.8	-0.054	0.79	-5.5
Ottawa-Gatineau	-0.046	1.32	6.7	-0.016	0.82	-3.8	-0.062	1.08	2.9
Montreal	-0.048	1.20	3.6	-0.057	0.93	0	-0.105	1.12	3.6
Trois-Rivires	0.033	0.94	-0.9	-0.309	0.86	-1.5	-0.276	0.81	-2.4
Sherbrooke	-0.053	0.77	-5.2	-0.024	1.14	3.8	-0.077	0.88	-1.4
Quebec	-0.049	0.93	-2.5	-0.127	1.33	8.4	-0.175	1.24	5.9
Saguenay	-0.214	1.72	9.2	-0.026	0.79	-3.8	-0.241	1.36	5.4
Saint John	0.011	1.35	4.7	-0.078	0.61	-11.9	-0.067	0.81	-7.2
Moncton				-0.174	0.87	-0.3			
Halifax	0.027	2.04	13.4	-0.028	0.68	-2.9	-0.001	1.38	10.5
St. Johns	-0.084	1.54	9.1	0.025	0.97	2.5	-0.059	1.50	11.6

Notes: Statistical test compares each estimate with the same estimate from a prior time period; colours indicate a statistical differnce compared to the combined estimate $p < .05$; (two-tailed tests). Red indicates a statistically higher estimate than the previous time period, greeen indicates a statistically lower estimate than the previous time period, and black indicates no statistical differnce from the previous time period.

Graph 4.3 illustrates the consistency in inequality in PMH from 2001-2006 to 2010-2015. Although the prevalence rates of all the quintiles increase, they do so nearly by equal amounts across the five quintiles, so the clear segregation in prevalence rate by quintile and therefore the measures of inequality remain the same. This is also reflected in table 4.4, which describes the change in CI, DRR and DRD for the three-time periods. There is no change in the absolute or relative measures at the national level, and those at the provincial level are primarily driven by the change of three cities (Vancouver, Calgary and Windsor) from the 2001-2005 to 2006-2010 time period. These changes reflect both a decreased inequality in the cities that in the 2001-2005 period, had amongst the highest inequalities in the country.



Graph 4.4: Prevalence Rate of Mood Disorder Among Income Quintiles Over Time

Graph 4.4 illustrates the quintile prevalence rates for MD across the three-time periods. Though there is no change in relative or absolute measures of inequality, the overall increase in inequality as measured by the CI (Table 4.5) can be seen by the increased separation of the quintiles; the 2nd, 3rd and 4th quintile are much closer together in 2001-2005 than they are in the 2006-2010 or 2011-2015 period. Though at the provincial and city-level there was little change in relative or absolute inequality, the CI fluctuated in larger amounts in the smaller cities and

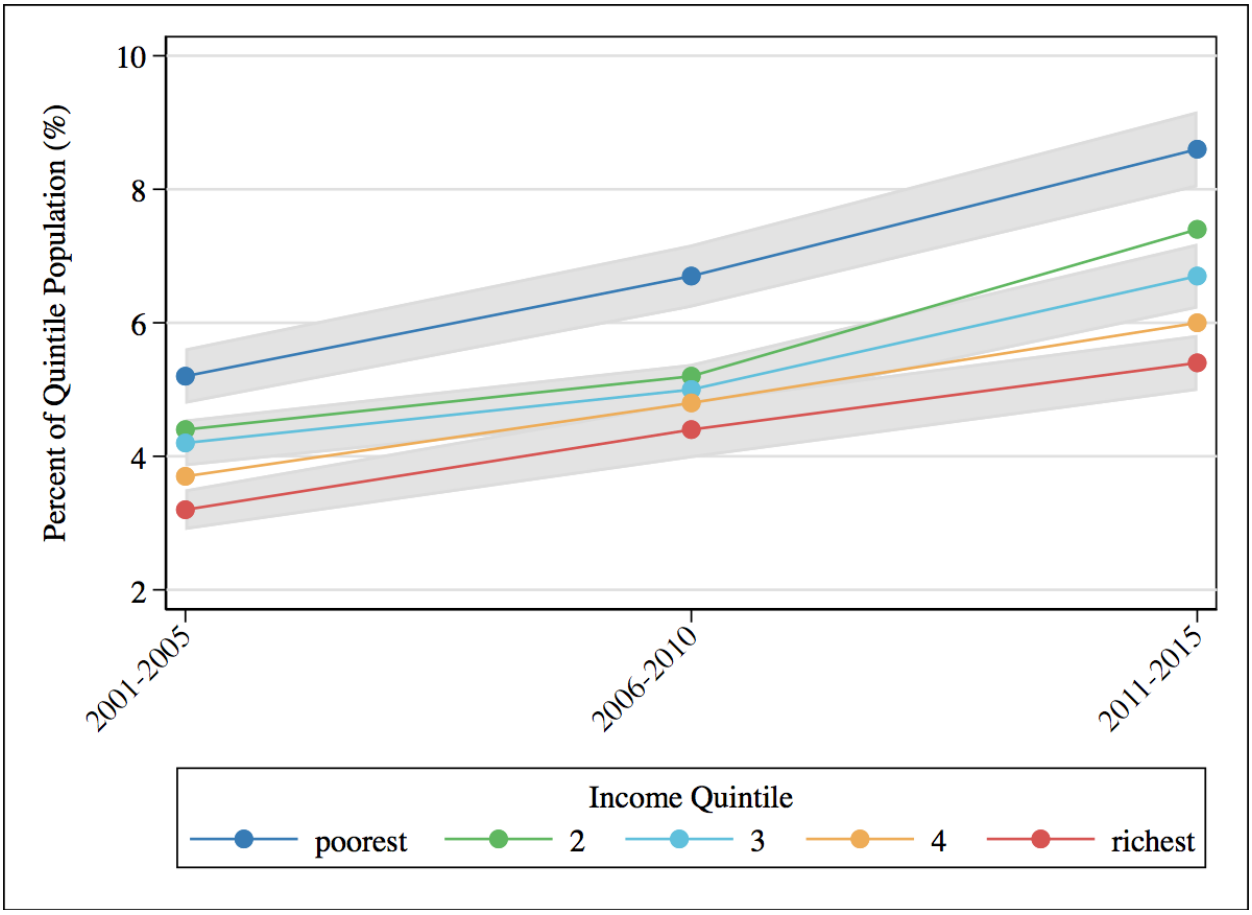
Table 4.5: Change in Measures of Mood Disorder Inequality Over Time in Urban Canada

	2001 - 2005 to 2006 - 2010			2006 - 2010 to 2011 - 2015			2001 - 2005 to 2011 - 2015		
	CI	DRR	DRD	CI	DRR	DRD	CI	DRR	DRD
Canada	-0.028	1.05	0.8	-0.082	0.96	0.1	-0.109	1.01	0.9
Province									
British Columbia	0.66	1.13	1	-0.12	0.75	-1.5	-0.081	0.84	-0.5
Alberta	-0.069	0.55	-4	-0.076	1.40	2.6	-0.145	0.77	-1.4
Saskatchewan	-0.009	1.18	2.5	-0.219	0.80	-0.9	-0.228	0.94	1.6
Manitoba	0.099	1.58	4.3	0.08	0.66	-3.1	0.179	1.04	1.2
Ontario	-0.037	0.97	0.4	-0.061	1.09	1	-0.098	1.06	1.4
Quebec	-0.056	1.25	1.5	-0.073	0.93	-0.6	-0.129	1.16	0.9
New Brunswick	0.006	0.97	-1.1	-0.038	0.53	-0.4	-0.032	0.52	-1.5
Nova Scotia	0.007	2.16	6.6	0.03	0.31	-7.6	0.038	0.66	-1
Newfoundland and Labrador	-0.095	1.63	3.7	-0.252	0.81	-0.7	-0.347	1.32	3
City									
Victoria	-0.076	1.56	3.9	-0.025	0.66	-4.1	-0.101	1.02	-0.2
Vancouver	0.026	1.04	0.3	-0.095	0.75	-1.1	-0.069	0.78	-0.8
Abbotsford - Mission	0.037	1.85	6.6	-0.072	0.93	-1.3	-0.036	1.72	5.3
Kelowna				-0.083	0.81	-2.6			
Calgary	-0.06	0.49	-4.4	-0.006	1.65	3.7	-0.066	0.81	-0.7
Edmonton	-0.076	0.62	-3.9	-0.145	1.13	1.4	-0.221	0.69	-2.5
Saskatoon	-0.042	1.98	7.3	-0.151	0.86	-2.2	-0.193	1.70	5.1
Regina	0.181	0.60	-1.6	-0.202	0.71	-0.9	-0.021	0.42	-2.5
Winnipeg	0.099	1.58	4.3	0.08	0.66	-3.1	0.179	1.04	1.2
Thunder Bay	-0.212	0.87	0.9	0.037	1.27	2.4	-0.176	1.11	3.3
Greater Sudbury / Grand Sudbury	0.074	0.44	-2.3	0.014	0.93	0	0.088	0.41	-2.3
Barrie				-0.177	0.66	-2.4			
Windsor	0.011	0.86	-1.1	0.231	1.11	-0.1	0.243	0.95	-1.2
London	-0.02	0.78	0.9	-0.14	1.47	3.6	-0.16	1.15	4.5
Guelph				0.083	0.51	-1.9			
Brantford				-0.13	0.87	-2.3			
Kitchener - Cambridge - Waterloo	-0.185	0.98	0.2	0.11	0.73	0.4	-0.075	0.72	0.6
St. Catharines - Niagara	-0.03	0.88	-0.9	-0.092	0.50	-3.7	-0.122	0.44	-4.6
Hamilton	-0.058	1.89	5.4	-0.072	0.76	0.1	-0.13	1.44	5.5
Toronto	-0.028	0.87	-0.6	-0.033	1.45	2.2	-0.061	1.26	1.6
Oshawa	-0.149	1.29	4	-0.001	0.83	-0.6	-0.149	1.07	3.4
Peterborough				0.115	4.08	13.1			
Kingston	-0.133	1.42	5.5	0.273	0.51	-5.5	0.139	0.73	0
Ottawa-Gatineau	-0.055	1.09	1.6	-0.05	0.76	-1.8	-0.104	0.83	-0.2
Montreal	-0.048	1.45	1.9	-0.072	0.89	-1	-0.119	1.29	0.9
Trois-Rivires	0.098	2.70	3.9	0.103	0.55	-1.3	0.201	1.49	2.6
Sherbrooke	0.01	0.80	1.2	-0.424	0.59	-3.5	-0.414	0.47	-2.3
Quebec	-0.071	0.65	-0.3	0.013	1.19	0.8	-0.058	0.77	0.5
Saguenay	-0.409	1.84	3.5	0.435	0.75	-0.1	0.025	1.38	3.4
Saint John	-0.034	1.29	1.7	0.395	0.27	-8.4	0.361	0.34	-6.7
Moncton				-0.111	0.91	6.1			
Halifax	0.007	2.16	6.6	0.03	0.31	-7.6	0.038	0.66	-1
St. Johns	-0.095	1.63	3.7	-0.252	0.81	-0.7	-0.347	1.32	3

Notes: Statistical test compares each estimate with the same estimate from a prior time period; colours indicate a statistical differnce compared to the combined estimate $p < .05$; (two-tailed tests). Red indicates a statistically higher estimate than the previous time period, greeen indicates a statistically lower estimate than the previous time period, and black indicates no statistical differnce from the previous time period.

provinces. The CI decreased in Manitoba (Winnipeg), Windsor, Saint John, but increased significantly in Saskatchewan, Newfoundland and Labrador (St. Johns), and Sherbrook.

Graph 4.5 shows the increase in inequality of AD from 2001-2005 to 2011-2015. The prevalence rate of all of the quintiles in 2001-2005 were all relatively close together, but the poorer quintiles increased prevalence at a much higher rate (1.2 percentage points more) than the richer quintiles leading to increased inequality in the latter time period (Table 4.6). This difference was driven by Manitoba (Winnipeg) and Ontario (largely due to an increase in Toronto). Overall inequality decreased in smaller cities such as Abbotsford-Mission, Saskatoon, Regina, Greater Sudbury/ Grand Sudbury and Windsor. In general, similar to both PMH and MD, the inequalities in AD were largely consistent or worsening slightly over time.



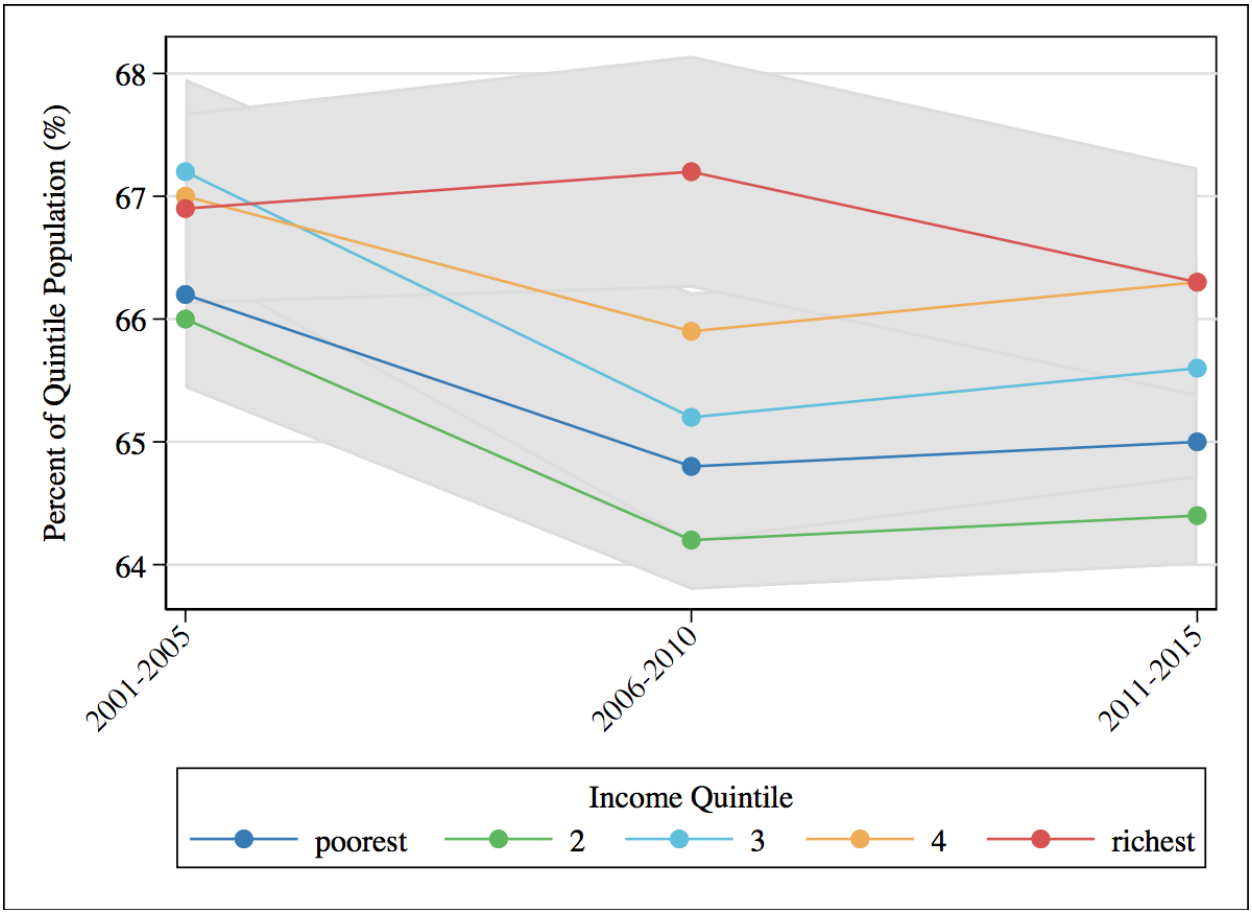
Graph 4.5: Prevalence Rate of Anxiety Disorder Among Income Quintiles Over Time

Table 4.6: Change in Measures of Anxiety Disorder Inequality Over Time in Urban Canada

	2001 - 2005 to 2006 - 2010			2006 - 2010 to 2011 - 2015			2001 - 2005 to 2011 - 2015		
	CI	DRR	DRD	CI	DRR	DRD	CI	DRR	DRD
Canada	-0.02	0.93	0.3	-0.094	1.05	0.9	-0.114	0.98	1.2
Province									
British Columbia	0.029	0.93	0	-0.055	0.93	0.2	-0.026	0.87	0.2
Alberta	-0.074	0.58	-1.1	-0.067	1.14	1.2	-0.14	0.67	0.1
Saskatchewan	-0.059	1.08	0.8	0.136	1.15	2.6	0.077	1.24	3.4
Manitoba	0.016	4.31	8.5	-0.03	0.45	-4	-0.014	1.95	4.5
Ontario	-0.021	1.02	0.5	-0.073	1.16	1.6	-0.094	1.18	2.1
Quebec	-0.036	0.75	-0.4	-0.133	1.04	0.4	-0.169	0.79	0
New Brunswick	0.018	1.19	0.5	-0.123	0.70	1.3	-0.105	0.84	1.8
Nova Scotia	0.007	2.13	0.9	-0.232	0.33	-1.3	-0.224	0.70	-0.4
Newfoundland and Labrador	-0.143	1.17	1.2	-0.139	1.01	2.8	-0.281	1.18	4
City									
Victoria	0.038	1.03	1.2	-0.11	1.53	1.1	-0.072	1.57	2.3
Vancouver	0.008	0.74	-1	-0.056	1.03	0.5	-0.048	0.76	-0.5
Abbotsford - Mission	0.017	2.41	5.6	0.237	0.44	-4.8	0.254	1.07	0.8
Kelowna				0.017	0.96	3.7			
Calgary	-0.049	0.53	-1.1	-0.049	1.41	1.7	-0.098	0.74	0.6
Edmonton	-0.073	0.74	-0.9	-0.095	0.87	0.6	-0.168	0.64	-0.3
Saskatoon	-0.075	1.13	1.2	0.299	1.50	3.9	0.224	1.69	5.1
Regina	0.267	1.63	0.6	-0.223	0.50	0.4	0.045	0.82	1
Winnipeg	0.016	4.31	8.5	-0.03	0.45	-4	-0.014	1.95	4.5
Thunder Bay	-0.221	1.58	2.3	0.186	0.69	-0.8	-0.035	1.10	1.5
Greater Sudbury / Grand Sudbury	0.027	1.04	0.3	0.324	0.75	0.4	0.352	0.78	0.7
Barrie				-0.042	0.53	-5.8			
Windsor	0.009	0.80	-1.3	0.233	1.34	1.8	0.242	1.07	0.5
London	0.111	1.14	3.1	-0.052	0.99	1.5	0.059	1.13	4.6
Guelph				0.119	1.23	3.9			
Brantford				0.038	0.54	-5.2			
Kitchener - Cambridge - Waterloo	-0.132	0.97	0.5	0.146	0.73	-1.5	0.014	0.71	-1
St. Catharines - Niagara	-0.059	1.10	0.5	0.08	0.85	1.1	0.021	0.94	1.6
Hamilton	0.014	1.68	3	-0.175	0.74	1	-0.161	1.24	4
Toronto	-0.013	0.90	-0.4	-0.08	1.51	2.3	-0.093	1.36	1.9
Oshawa	-0.08	1.14	2.7	-0.036	1.13	1.2	-0.115	1.30	3.9
Peterborough				0.06	0.94	4.1			
Kingston	-0.122	0.63	0.2	0.071	1.39	6.5	-0.051	0.87	6.7
Ottawa-Gatineau	-0.111	1.22	2.4	0.039	0.95	-0.3	-0.072	1.15	2.1
Montreal	-0.039	0.67	-1.2	-0.099	1.06	0.4	-0.138	0.71	-0.8
Trois-Rivires							-0.242	1.93	5.1
Sherbrooke	0.237	1.26	2.2	-0.463	0.67	-3.2	-0.226	0.84	-1
Quebec	-0.11	0.55	-1	-0.028	2.03	4.3	-0.138	1.13	3.3
Saguenay	0.004	0.62	-0.4	-0.348	0.65	-1.4	-0.345	0.40	-1.8
Saint John	-0.058	1.69	3.4	0.186	0.69	-1.4	0.127	1.16	2
Moncton				0.001	0.72	1.4			
Halifax	0.007	2.13	0.9	-0.232	0.33	-1.3	-0.224	0.70	-0.4
St. Johns	-0.143	1.17	1.2	-0.139	1.01	2.8	-0.281	1.18	4

Notes: Statistical test compares each estimate with the same estimate from a prior time period; colours indicate a statistical differnce compared to the combined estimate $p < .05$; (two-tailed tests). Red indicates a statistically higher estimate than the previous time period, greeen indicates a statistically lower estimate than the previous time period, and black indicates no statistical differnce from the previous time period.

Finally, Graph 4.6 shows the consistency in the lack of inequality in the PMH Indicator over time. Table 4.7 reports the gap between the richest and poorest quintile increases by only 0.6% over the time periods, which is a statistically insignificant amount. There was no overall meaningful change at the national, provincial or city levels from 2001-2005 to 2011-2015.



Graph 4.6: Prevalence Rate of Life Stress Among Income Quintiles Over Time

Table 4.7: Change in Measures of Life Stress Inequality Over Time in Urban Canada

	2001 - 2005 to 2006 - 2010			2006 - 2010 to 2011 - 2015			2001 - 2005 to 2011 - 2015		
	CI	DRR	DRD	CI	DRR	DRD	CI	DRR	DRD
Canada	-0.01	0.97	-1.7	-0.038	1.02	1.1	-0.048	0.99	-0.6
Province									
British Columbia	-0.007	0.97	-1.7	-0.047	1.01	0.8	-0.054	0.98	-0.9
Alberta	-0.01	1.00	-0.5	-0.061	0.98	-1	-0.071	0.98	-1.5
Saskatchewan	0.006	1.09	5.2	-0.012	0.88	-8.2	-0.007	0.96	-3
Manitoba	0.031	1.00	0.4	-0.081	0.96	-2.7	-0.05	0.96	-2.3
Ontario	-0.01	0.98	-1.3	-0.038	1.03	2	-0.048	1.01	0.7
Quebec	-0.014	0.94	-3.9	-0.013	1.02	1.3	-0.027	0.96	-2.6
New Brunswick	0.002	1.12	7.3	-0.06	0.91	-6	-0.059	1.02	1.3
Nova Scotia	0.008	0.88	-8.3	-0.051	1.13	8.2	-0.043	0.99	-0.1
Newfoundland and Labrador	-0.012	0.93	-4.3	-0.072	1.15	8.2	-0.083	1.07	3.9
City									
Victoria	-0.034	0.99	-0.6	-0.026	1.06	3.2	-0.06	1.05	2.6
Vancouver	-0.013	0.97	-1.7	-0.049	1.00	0.2	-0.062	0.97	-1.5
Abbotsford - Mission	0.028	0.83	-10.7	-0.069	1.22	11.3	-0.042	1.01	0.6
Kelowna				-0.036	0.92	-4.6			
Calgary	-0.003	0.95	-3.6	-0.05	1.00	-0.3	-0.053	0.95	-3.9
Edmonton	-0.023	1.04	2.6	-0.067	0.98	-1.5	-0.09	1.02	1.1
Saskatoon	0.006	1.26	13.7	0.005	0.80	-14.1	0.011	1.00	-0.4
Regina	0.014	0.93	-4.4	-0.034	0.97	-2.7	-0.021	0.90	-7.1
Winnipeg	0.031	1.00	0.4	-0.081	0.96	-2.7	-0.05	0.96	-2.3
Thunder Bay	0.006	0.79	-15.9	-0.02	1.19	11.6	-0.015	0.95	-4.3
Greater Sudbury / Grand Sudbury	0.022	0.88	-8.6	0.002	1.04	3.2	0.024	0.91	-5.4
Barrie				-0.043	1.13	8.5			
Windsor	-0.016	1.01	0.4	0.019	0.95	-3.4	0.003	0.96	-3
London	0.023	1.01	0	-0.076	1.02	1.8	-0.053	1.03	1.8
Guelph				-0.074	1.12	7.3			
Brantford				-0.055	0.96	-2.9			
Kitchener - Cambridge - Waterloo	-0.024	0.92	-5.7	-0.011	1.05	3.6	-0.035	0.97	-2.1
St. Catharines - Niagara	-0.057	1.02	0.8	0.063	0.94	-3.3	0.006	0.96	-2.5
Hamilton	-0.023	1.11	6.7	-0.012	0.93	-5	-0.034	1.03	1.7
Toronto	-0.013	1.00	-0.5	-0.033	1.02	2	-0.047	1.02	1.5
Oshawa	-0.027	0.92	-6.1	-0.035	1.19	12.7	-0.063	1.09	6.6
Peterborough				-0.075	1.15	8.9			
Kingston	0.03	0.96	-2.7	-0.092	1.03	1.9	-0.062	0.99	-0.8
Ottawa-Gatineau	-0.015	0.93	-4.3	-0.014	1.03	2	-0.029	0.96	-2.3
Montreal	-0.018	0.93	-4.9	-0.009	1.03	2.5	-0.027	0.96	-2.4
Trois-Rivires	-0.023	1.08	5	-0.074	0.87	-8.9	-0.097	0.94	-3.9
Sherbrooke	0.021	0.79	-14.8	-0.056	1.25	14.2	-0.036	0.99	-0.6
Quebec	-0.018	1.00	0.1	-0.049	0.94	-3.8	-0.067	0.94	-3.7
Saguenay	-0.006	1.03	2.3	0.046	1.25	13.4	0.04	1.29	15.7
Saint John	-0.028	1.31	17.1	0.016	0.96	-2.6	-0.013	1.26	14.5
Moncton				-0.079	0.84	-11.3			
Halifax	0.008	0.88	-8.3	-0.051	1.13	8.2	-0.043	0.99	-0.1
St. Johns	-0.012	0.93	-4.3	-0.072	1.15	8.2	-0.083	1.07	3.9

Notes: Statistical test compares each estimate with the same estimate from a prior time period; colours indicate a statistical differnce compared to the combined estimate $p < .05$; (two-tailed tests). Red indicates a statistically higher estimate than the previous time period, greeen indicates a statistically lower estimate than the previous time period, and black indicates no statistical differnce from the previous time period.

4.5 Discussion

These results confirm and expand upon what is already known about health inequalities in Canada; namely that mental health outcomes are significantly worse for urban Canadians living with less income, and that these inequalities are being maintained or worsening over time.

This study highlights how widespread mental health inequalities are in Canada. The very lowest rates of inequalities show that the poorest populations are 1.2 times more likely to have a MD or AD while in the most unequal cities, that number is 3 times as likely. This study also examined how prevalence rates and inequalities changed over time. Inequalities are staying relatively constant or only marginally increasing, this indicates that in order to maintain inequality the already higher rates of individuals living in poor neighbourhoods are increasing at the same or higher rates of the richest neighbourhoods.

Not in agreement with previous literature was the prevalence rates in MD, AD and PMH over time. This study found an overall prevalence of 7.3% for MD and 6.8% for AD, which is lower than the 10% reported in other studies. However, the previous study reported MD and AD combined, so it is likely that the current estimates accurately represent the population. However, the change in prevalence rate over time was not in agreement with prior literature. This study found a statistically significant increase in PMH, MD and AD, while PHAC and CIHI data indicated no change. [12,13] There are a number of explanations for this discrepancy. The first is that this study only examined urban populations. Previous research found the prevalence of mental health in rural areas to be lower than urban areas, [28] so it is possible that the exclusion of rural results elucidated an urban specific trend. The second explanation is that the time of reports is different, the previous research cited was published earlier than this study, so it is possible that this is a new trend. This would also be in agreement with other literature that found increased rates of depression with the increased economic downturn- such as the Candian Recession in 2008-2009. [29,30] The final explanation is that the CCHS is a self-reported survey that surveys a subset of the Canadian population. This introduces potential errors in underreporting due to Social Desirability that would not be seen in administrative data. [31] Regardless of the explanation, this finding indicates a need for better data on mental health outcomes in Canada, as well as consistent tracking. The need for better mental health data has been outlined in depth by the Mental Health Commission of Canada. [32]

To my knowledge, this is the first study to examine inequalities in mental health at three different levels of geography over time. This study therefore uniquely adds to the literature in this area by speculating that inequalities do not behave the same way at each level of geography. That is to say, this study suggests that prevalence rates and inequalities are more extreme in smaller cities compared to bigger cities, provinces, or national estimates and that cities within the same province do not behave more similarly due to geographical similarities. At first glance these are important findings that warrant further discussion and research. However, while results are interesting and could have important implications on policy, they must be interpreted with care as limitations due to sample size could have inflated the variance in small cities.

The CCHS uses sample weights to align the survey sample with the Candian population, as such the responses of certain individuals are weighted heavily compared to others. In large cities, or at the national level, the addition of one or two such heavily weighted individual

responses in quintile one or five will not make a large difference to the inequality estimate, however, in some small cities where ten or fewer individuals might be surveyed to account for the whole city, the addition of one or two of these individuals can sway the estimates and produce inflated results. Additionally, in the case of provinces, large provinces such as Ontario, and Quebec are estimates of multiple cities, but provinces such as Manitoba and Newfoundland and Labrador are represented solely by Winnipeg and St. Johns, themselves small cities.

While the limitations in sample side preclude this study from definitively concluding that small cities have more extreme results, this study can conclude the importance of analyzing results at the city level. The national or provincial levels are not exact enough to give meaningful results for the purpose of policy change. For example, the disparity rate ratios for AD in Quebec range from 0.96 in Sherbrooke, which would indicate a lack of inequality, to 2.68 in Quebec, indicating a very large inequality, for a provincial average of 1.63. Even with room for error due to sample size, it is clear that these rates are not the same. These city-level differences are not seen in the provincial estimate which is very close to the national estimate.

Therefore this study can conclude that city-level results should be interpreted for thematic purposes and for suggestions for further study, as well as to underline the importance of city-level research, but not for direct analysis. The need for a more detailed survey has been previously identified:

> "Although the CCHS facilitates a better understanding of the relationship between individual SES and health, it is not local enough to provide information on the contexts in which these relationships play out" [33]

The measure of LS did not follow the same patterns as PMH, AD or MD. While inequality was seen in the later three health outcomes, there was little inequality due to income in reports of LS. The prevalence rate of LS decreased over time, not increasing like the other three variables, and the change in inequality over time was so small it was not meaningful. I propose several theories as to why this variable did not follow the expected pattern.

First, it could be an issue of how the variable was coded. The original question asked by the CCHS was asked with five categories of responses, which was coded into dichotomous form. The presence of life stress was recorded as the respondent reporting that he or she found most days "a bit", "quite a bit", or "extremely" stressful. It is, therefore, possible that this was too broad a response, and different results would have been encountered had the response of life stress only been taken to mean "quite a bit" or "extremely". However, the variable for PMH was asked in a very similar way and coded in the same manner, so if over-generality was the cause for the lack of expected results, I would have expected that the PMH variable would be similarly unexpected. Statistics Canada also released statistics of the same variable that is coded for only "quite a bit" or "extremely", and the trend appears to be decreasing. [34]

The second theory is that there is a societal stigma surrounding mental health that does not encompass the societal notions of life stress. [35] Therefore individuals might be more willing to report their lives being more stressful than they would if their lives have been not mentally healthy. In the same manner of thinking it is possible that stress is desirable in higher socioeconomic status as it is associated with business, productivity and therefore wealth. [36] Then, proportionally more individuals in high socioeconomic status would be willing to report their lives as stressful, but their mental health as good.

The last plausible theory is that society does not equate all types of stress with mental health. [37] As stress can be seen as a completely qualitative variable experienced differently by two people in identical situations, it is possible that respondents did not answer the question about the stress of their lives with consideration about their mental health. The idea that there are different subdivision of stress, or that stress can be good or bad was introduced by Dr. Selye. [38] This concept of eustress (good) and distress (bad) was expanded upon to describe how a person is affected by stress is dependent upon whether they have an internal or external locus of control, that is, if they perceive the outcome of the situation to be dependant on them (internal) or on other factors (external). If the situation is stressful, but they perceive themselves to have control over it, it is deemed as eustress, and does not have the same negative impacts on that individual's wellbeing. However, if the person perceives themselves to have no control over the situation, it is deemed distress, and may have negative health implications, potentially leading to mental health disorders. [39,40] Therefore the question asking about the broad term of self-reported stress could be interpreted as eustress or distress and therefore be high or low independently of self-reported mental health, Anxiety or Depression.

This study used three measures of inequality, each of which reported on different aspects of inequality. The absolute and relative measures provided measures that were intuitive to understand, though they were infrequently statistically significant which could suggest a type 1 error. Though having three measures introduced confusion in interpretation when the direction of inequalities differed, given the dynamic nature of the inequalities when combined with changing prevalence rates, it was necessary to give a more complete picture of inequalities. This was especially apparent when examining the rate of change of the national inequalities for anxiety. The overall prevalence rate increased at the same proportion of the separation between the first and fifth quintile so that if only the DRR were used, the inequality would appear to be constant, when in reality by examining the graph 4.6 as well as the DRD and CI measures, it was clear that the inequality was increasing over time.

This study met its objectives of quantifying the rates of mental health indicators at the national, provincial and city-level while confirming the consistent and worsening presence of inequalities at each level of geography across the country. It provided evidence of the need for city-specific analysis of health inequalities, as important small city level outcomes can be masked by larger cities when examining provincial outcomes.

There were a number of limitations in this study. Aside from the aforementioned limitations due to sample size, this study used an area-based measure for income and health outcomes. The benefits and drawbacks of using these methods have sparked much discussion. [33] Some studies intentionally use area-based measures as they represent a collective population-level experience that is not captured by individual-level measures. That is, it is suggested that there is both an individual-level effect on health of having a low socioeconomic status, and a different or additional effect on health of living in a low socioeconomic neighbourhood. The main limitation of using area-based measures in this context is the possibility of committing an ecological fallacy, [41] that is making deductions about individuals based on the population they belong to. Due to the availability of variables relating to health and income in Canada, the use of area-based measures could not be avoided. Future research could

examine the relative impact of individual and area-based socioeconomic status on mental health inequalities in urban Canada.

This paper was not able to examine the determinants of the inequalities, so inequity, the moral counterpart of inequalities that describes avoidable, unfair and unjust inequalities was purposely not discussed. Further research into the underlying causes of the inequalities will need to be conducted in order to determine where inequities exist, then form actionable processes to reduce and eliminate their presence in Canada.

In closing, this study serves as evidence of mental health inequalities that emphasize the need for continued city level surveillance of these indicators as well as underlying the need for further work in deconstructing the determinants of mental health inequality in Urban Canada.

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5. DESCRIPTIVE EPIDEMIOLOGY OF THE LIFETIME EXPERIENCE OF MENTAL HEALTH DISORDERS IN URBAN CANADA

5.1 Abstract

Introduction

Mental health inequalities are widespread and maintained in Canada. These inequalities are often reported in terms of income but the upstream causes of the inequalities are multifaceted. In order to reduce inequalities, effective interventions pertaining to the Social Determinants of Health (SDOH) must be implemented. This study examines how the social determinants of health influence the prevalence of mental health and addictions in urban Canada.

Methods

The mental health component of the 2012 Canadian Community Health Survey, a cross-sectional national survey, was linked to neighbourhood income quintiles from the Canadian Census of Population. Prevalence rates of four mental health outcomes (Mood Disorder, Anxiety Disorder, Substance Use Disorder and Any Mental or Substance Disorder) were calculated at the national level.

Fifteen covariates that describe demographics, socioeconomic status, culture, home life, mental health predictor and other characteristics were selected. Each covariate was individually added to a simple logistic regression with each of the mental health outcomes. Four multiple logistic regression models were then developed using a stepwise addition procedure.

Results

At the national level, 12.1% of Canadians had a Mood Disorder, 8.0% had an Anxiety Disorder, 20.0% had a Substance Use Disorder, and 30.8% had Any Mental or Substance Disorder. In the simple logistic regression analysis, all of the categories had significantly impacted on the odds of having a mental health disorder. The effect of the covariates varied by mental health outcomes in the multiple logistic regression models.

Discussion

Mental health disorders are not homogeneous in their relationship with the SDOH. By examining the differences in the impact the SDOH has on mental health disorders, this paper highlights the need for increased data and monitoring of the SDOH surrounding mental health outcomes in Canada. These data need to be city-specific, include in-depth descriptions of mental health disorders and be collected at regular intervals.

5.2 Introduction

Mental health disorders are largely considered to be the product of social determinants of health. [1] In 2001, the Public Health Agency of Canada released a list of 12 Social Determinants of Health (SDOH): income and social status, employment and working conditions, education and literacy, childhood experiences, physical environments, social supports and coping skills, healthy behaviours, access to health services, biology and genetic endowment, gender, culture, and race/racism. [2] Income has been lauded as the most important determinant of health. [3] This is largely because the other social determinants of health directly or indirectly impact income, [4,5] so income is often able to give a general image of the inequalities due to SDOH in a given population. As seen in the previous manuscript, in urban Canada, there is widespread and maintained mental health inequalities due to income.

Public Health strategies often focus on "upstream" interventions, that is, they use strategies that reduce the severity of factors that increase the risk of an individual or population having worse health. [6] These strategies are preferable for multiple reasons including that they not only reduce poor health of the population, but they do so by increasing the wellness of the target population, and over time, can be more cost effective than other "downstream" or reactionary measures. [7,8] For example, the recent Housing First initiative in Regina demonstrated how providing housing to a group of 26 vulnerable individuals decreased their emergency service encounters, hospital and detox visits and saved over $1.92 million. [9]

In order to understand which interventions will best serve the population, it is necessary to deconstruct the income inequality measure. Income measures alone can not describe the underlying reasons behind inequality. [10] Therefore, the next step in understanding and subsequently reducing inequalities in Canada is to understand how other determinants of health contribute to the inequalities described.

Previous research has found an association between age, [11] sex, [12–14] income,[15,16] education, [17,18] employment, [19] immigration, [20–24] ethnicity, [25–27] marital status, [11,28] presence of chronic conditions, [11,29,30] sexuality, [31–34] and mental health outcomes of Mood Disorder, Anxiety Disorder and Substance Use Disorder. However, there is a lack of research that evaluates the impact of all these variables together and examines Mood Disorder, Anxiety Disorder and Substance Use Disorders using the same covariates.

This study examined how social determinants of health influence the prevalence of mental health and addictions in urban Canada.

5.3 Methods

5.3.1 Study Design

The study design is a secondary data analysis of a national cross-sectional survey, the Community Health Survey-Mental Health Component (CCHS-MH)

5.3.2 Data Source

Data for this study were collected from two sources maintained by Statistics Canada- CCHS-MH and the Canadian Census of Population (Census).

Individual-level health data was collected from the CCHS-MH. The CCHS-MH is a national cross-sectional survey administered in 2012 to a representative sample of Canadians over 15 years old. Detailed sampling methods are discussed elsewhere. [35] Briefly, the CCHS-MH component covers the population aged 15 and over living in one of the 10 Canadian

provinces excluding those living on reserves and other Aboriginal settlements, full-time members of the Canadian Forces, and residents of institutions. Together, these exclusions make up about 3% of the Canadian population.

Neighbourhood level income data was collected from the Census. The Census is a mandatory survey completed by every Canadian dwelling, collecting information on the population of Canada every five years. [36] The Candian Census in 2011 was used.

5.3.3 Study Size

The CCHS recorded responses for 25,113 individuals. This sample was restricted to include only residents of urban metropolitan cities.

5.3.4 Setting

Urbanity was determined if participants resided in a Dissemination Area in one of Canada's Census Metropolitan Areas (CMA), that had a population density of above 400 persons per square km and a total population over 1000. [37] A CMA is defined as a collection of municipalities situated around a core that has a population of at least 100,000 people. [38]

5.3.5 Variables

5.3.5.1 Mental Health Outcome Variables

Four dichotomous mental health outcome variables were selected from the CCHS-MH: Mood Disorder, Anxiety Disorder, Substance Use Disorder, and Any Mental or Substance Disorder. Variables were constructed by the CCHS using the WHO-CIDI criteria for each disorder. **Mood Disorder (MD)** was comprised of a lifetime prevalence of Major Depressive Disorder or Bipolar Disorder. **Anxiety Disorder (AD)** was comprised of a lifetime prevalence of Generalized Anxiety Disorder. **Substance Use Disorder (SUD)**, also known as Alcohol or Drug Use Disorder, was comprised of Alcohol Dependance or Abuse, Cannabis Dependence or Abuse, Other Drug Dependance or Abuse. **Any Mental or Substance Disorder** was an agglomeration of any lifetime prevalence of a Mood, Anxiety or Substance Use Disorder.

5.3.5.2 Social Determinants of Health Variables

5.3.5.2.1 Demographic Variables

Demographic variables included CMA, sex and age.

The CMA variable from the census was matched to the respondent's CCHS-MH responses using postal code information. Toronto was used as the CMA reference category.

The sex variable from the CCHS-MH was dichotomously coded as male or female. Male was used as the reference category.

Age, recorded as a continuous variable in the CCHS-MH was grouped into four categories, 15-24, 25-44, 45-64 and 65+, of which the 25-44-year-old grouping was used as the reference category.

5.3.5.2.2 Socioeconomic Variables

Socioeconomic variables included two measures of income quintiles (individual and neighbourhood), individual education and employment status.

Neighbourhood-level income was calculated using variables from the Census. The after-tax income variable was adjusted by the square root of the average number of people living

in the household. Neighbourhood adjusted income was then calculated as the average adjusted household income in each DA. The average adjusted incomes for each DA were then ranked within each CMA, and quintiles were then assigned.

Individual-level income quintiles were calculated in the same manner, with the exceptions of using the self-reported income and household size variables from the CCHS-MH instead of the census variables, and not averaging the adjusted income at the DA level. The richest quintile (Q5), was used as the reference category for both measures.

Education level was determined using the self-reported CCHS-MH variable which grouped educational achievement into four categories: less than secondary school graduation, secondary school graduation, post-secondary school graduation, more than post-secondary school. The post-secondary graduation category was used as the reference category.

Employment was determined by the self-reported CCHS-MH variable describing working status in the prior two weeks. This variable was then dichotomously coded to the presence or absence of a job in the last two weeks. The "employed in the last 2 weeks" category was used as the reference category.

5.3.5.2.3 Cultural Variables

Culture was described using variables of ethnicity and immigration.

Ethnicity was categorized into white, black, asian, arab, latin american, indigenous, and multiple or other ethnicity based on the self-reported CCHS-MH Variable. White ethnicity was used as the reference category.

The continuous self-reported length of time since immigration to Canada variable from the CCHS-MH was recorded into groups of non-immigrant, living in Canada for 0-2 years, for 3-10 years, for 11-20 years and for greater than 20 years. The non-immigrant group was used as the reference category.

5.3.5.2.4 Homelife Variables

The homelife variables included marital status and household type variables.

Marital status was derived based on the self-reported marital status variable in the CCHS-MH. The derived categories included: married or common-law, widowed or divorced, and single, never married. The married or common-law group was used as the reference category.

The household type variable describes who the respondent lived with. This variable was derived by grouping categories of the self-reported CCHS variable describing household type. Categories include couple alone, individual alone, couple with children, individual with children and other. The couple alone grouping was used as the reference category.

5.3.5.2.5 Other Variables

Other variables included sexuality and chronic condition variables; variables that have been found to significantly impact mental health disorders but did not fit into other categories.

Sexuality was grouped into two categories based on the self-reported CCHS-MH variable: heterosexual and homosexual or bisexual. Heterosexual was used as the reference category.

Chronic conditions were dichotomously coded into the presence or absence of chronic conditions, based on the self-reported CCHS-MH variable. The absence of a chronic condition was used as the reference category.

5.3.5.2.6 Mental Health Variables

The final two variables included were mental health status and a sense of community belonging.

Mental health status was derived using the CCHS-MH's Positive Mental Health variable which used the Mental Health Continuum-Short Form to classify respondents with flourishing, languishing or moderate mental health. Flourishing mental health was used as the reference category.

The sense of community belonging variable derived from the CCHS-MH described respondents as having a strong sense or a weak sense of community belonging. A strong sense of community belonging was used as the reference category.

5.3.6 Data Analysis

As the outcome variables were dichotomous, logistic regression was used.

Four simple logistic regression models were constructed to describe the relationship between each of the outcome variables (MD, AD, SUD and Any Mental or Substance Disorder) with each of the covariate variables (age, sex, CMA, neighbourhood income, individual income, education, employment, immigrant length in Canada, ethnicity, marital status, household type, chronic condition, sexuality, mental health status, and sense of community belonging). Odds Ratios(OR) and 95% Confidence Intervals(CI) were calculated.

A multilevel logistic well-formulated stepwise modelling approach was used to determine adjusted odds ratios with 95% confidence intervals. In line with the study's purpose of deconstructing the inequality in neighbourhood income in Canadian Cities, these variables, along with the demographics of age and sex were included in every model. Wald's statistic was used to determine the final model.

All data analysis was conducted using Stata 14 software (StataCorp. 2015. Stata Statistical Software: Release 14. College Station, TX: StataCorp LP.) available within the Saskatchewan Research Data Centre (SKY-RDC).

Ethics approval was exempt from the University of Saskatchewan Behavioural Research Ethics Board.

5.4 Results

Table 5.1 presents the observed frequencies, Odds Ratios and 95% Confidence Intervals for each of the covariates for each mental health disorder outcome.

Table 5.1: Simple Logistic Regression Models: OR of reporting Mental Health Outcomes by sociodemographic and lifestyle characteristics, Urban Canada 2012

		OR of reporting Mental Health Outcomes (95% CI)			
Variable	percent of population	Mood Disorder	Anxiety Disorder	Substance Use Disorder	Any Mental or Substance Disorder
age					
25-44	35.8%	1	1	1	1
15-24	16.9%	1.03 (0.82 to 1.24)	**0.72 (0.53 to 0.92)**	0.88 (0.73 to 1.02)	0.89 (0.76 to 1.02)
45-64	32.0%	1.01 (0.83 to 1.18)	1.17 (0.95 to 1.39)	0.91 (0.77 to 1.05)	1.01 (0.88 to 1.15)
65+	15.3%	**0.51 (0.40 to 0.62)**	**0.72 (0.55 to 0.89)**	**0.48 (0.39 to 0.57)**	**0.56 (0.47 to 0.64)**
sex					
male	49.3%	1	1	1	1
female	50.7%	**1.48 (1.25 to 1.70)**	**1.88 (1.56 to 2.21)**	**0.32 (0.28 to 0.37)**	**0.64 (0.57 to 0.71)**
neighbouhood income					
richest	19.6%	1	1	1	1
4	18.8%	1.09 (0.81 to 1.38)	1.07 (0.73 to 1.40)	0.96 (0.75 to 1.18)	1.00 (0.79 to 1.20)
3	19.0%	1.15 (0.87 to 1.43)	0.96 (0.69 to 1.23)	1.05 (0.83 to 1.27)	0.99 (0.81 to 1.18)
2	21.9%	1.08 (0.83 to 1.33)	1.11 (0.83 to 1.39)	**1.29 (1.02 to 1.57)**	1.15 (0.94 to 1.36)
poorest	20.7%	**1.51 (1.17 to 1.85)**	**1.37 (1.01 to 1.73)**	1.04 (0.83 to 1.25)	1.10 (0.90 to 1.29)
individual income					
richest	19.4%	1	1	1	1
4	20.0%	1.10 (0.82 to 1.39)	1.10 (0.76 to 1.44)	0.91 (0.73 to 1.08)	0.93 (0.76 to 1.10)
3	20.5%	**1.39 (1.07 to 1.72)**	0.90 (0.66 to 1.15)	**0.81 (0.65 to 0.98)**	0.86 (0.71 to 1.01)
2	19.8%	1.24 (0.95 to 1.54)	1.03 (0.72 to 1.34)	**0.55 (0.44 to 0.65)**	**0.66 (0.55 to 0.77)**
poorest	20.3%	**1.49 (1.16 to 1.82)**	**1.37 (0.98 to 1.75)**	**0.62 (0.49 to 0.74)**	**0.75 (0.62 to 0.88)**
education					
post-secondary graduation	60.9%	1	1	1	1
some post-secondary	7.5%	**1.57 (1.17 to 1.97)**	1.31 (0.90 to 1.71)	**1.52 (1.15 to 1.88)**	**1.43 (1.12 to 1.74)**
secondary school graduation	15.4%	0.99 (0.79 to 1.18)	1.00 (0.75 to 1.24)	**1.22 (1.03 to 1.42)**	1.04 (0.89 to 1.20)
less than secondary school graduation	16.2%	0.87 (0.69 to 1.04)	0.84 (0.65 to 1.03)	0.90 (0.74 to 1.06)	**0.80 (0.67 to 0.93)**
employment					
employed in last 2 weeks	69.2%	1	1	1	1
unemployed in last 2 weeks	30.8%	**1.18 (0.99 to 1.36)**	**1.42 (1.17 to 1.68)**	**0.67 (0.58 to 0.76)**	**0.85 (0.74 to 0.95)**
immigrant length in Canada					
non-immigrant	66.6%	1	1	1	1
0-2 years	2.7%	**0.35 (0.13 to 0.57)**	**0.21 (0.01 to 0.42)**	**0.25 (0.12 to 0.39)**	**0.24 (0.13 to 0.34)**
3-10 years	7.0%	**0.53 (0.34 to 0.73)**	**0.31 (0.16 to 0.47)**	**0.19 (0.12 to 0.25)**	**0.28 (0.20 to 0.35)**
11-20 years	8.5%	**0.67 (0.45 to 0.89)**	**0.47 (0.26 to 0.68)**	**0.11 (0.06 to 0.15)**	**0.28 (0.21 to 0.36)**
21+ years	15.3%	**0.55 (0.42 to 0.69)**	**0.51 (0.36 to 0.66)**	**0.35 (0.27 to 0.43)**	**0.39 (0.32 to 0.47)**
ethnicity					
white	69.7%	1	1	1	1
black	3.3%	0.91 (0.47 to 1.35)	**0.43 (0.13 to 0.73)**	**0.25 (0.13 to 0.37)**	**0.41 (0.26 to 0.57)**
asian	17.7%	**0.50 (0.35 to 0.64)**	**0.40 (0.27 to 0.52)**	**0.16 (0.11 to 0.21)**	**0.25 (0.20 to 0.30)**
arab	1.5%	0.78 (0.25 to 1.31)	0.77 (0.15 to 1.40)	**0.10 (-0.02 to 0.22)**	**0.29 (0.12 to 0.45)**
latin american	2.2%	0.99 (0.49 to 1.49)	**0.31 (0.01 to 0.62)**	**0.51 (0.28 to 0.74)**	**0.49 (0.27 to 0.70)**
aborigional	2.5%	**1.47 (0.92 to 2.02)**	**1.76 (1.17 to 2.35)**	**2.63 (1.84 to 3.42)**	**2.49 (1.75 to 3.23)**
other or multiple	3.1%	0.98 (0.52 to 1.43)	**0.50 (0.17 to 0.82)**	**0.52 (0.29 to 0.74)**	**0.56 (0.37 to 0.76)**

marital status					
married or common law	57.2%	1	1	1	1
widowed, separated, or divorced	12.9%	**1.62 (1.32 to 1.93)**	**1.70 (1.32 to 2.08)**	**0.83 (0.68 to 0.98)**	1.13 (0.95 to 1.31)
single never married	29.9%	**1.57 (1.32 to 1.82)**	1.17 (0.95 to 1.38)	**1.35 (1.18 to 1.53)**	**1.34 (1.18 to 1.50)**
household type					
couple alone	24.1%	1	1	1	1
individual alone	15.1%	**1.72 (1.43 to 2.00)**	**1.24 (1.00 to 1.48)**	**1.33 (1.15 to 1.52)**	**1.44 (1.27 to 1.61)**
couple with children	10.9%	**1.40 (1.05 to 1.76)**	1.14 (0.81 to 1.47)	0.98 (0.75 to 1.20)	1.05 (0.82 to 1.27)
individual with children	43.4%	0.88 (0.70 to 1.06)	**0.60 (0.47 to 0.74)**	0.91 (0.77 to 1.06)	**0.83 (0.72 to 0.94)**
other	6.5%	**1.44 (1.01 to 1.87)**	0.87 (0.53 to 1.22)	**2.03 (1.56 to 2.51)**	**1.79 (1.40 to 2.18)**
chronic conditions					
no chronic condition	44.2%	1	1	1	1
chronic condition	55.8%	**3.35 (2.77 to 3.94)**	**4.84 (3.73 to 5.95)**	**1.43 (1.24 to 1.63)**	**2.09 (1.83 to 2.35)**
sexuality					
heterosexual	97.7%	1	1	1	1
homorosexual or bisexual	2.3%	**2.84 (1.95 to 3.73)**	**3.11 (1.96 to 4.25)**	**3.47 (2.42 to 4.52)**	**3.78 (2.65 to 4.92)**
mental health status					
flourishing mental health	76.2%	1	1	1	1
languishing mental health	1.5%	**14.48 (8.87 to 20.08**	**11.16 (6.79 to 15.53**	**2.31 (1.43 to 3.19)**	**7.09 (3.80 to 10.39)**
moderate mental health	22.3%	**3.25 (2.75 to 3.75)**	**3.08 (2.54 to 3.62)**	**1.80 (1.55 to 2.04)**	**2.39 (2.08 to 2.69)**
sense of community belonging					
somewhat strong or very strong	61.5%	1	1	1	1
somewhat weak or very weak	38.5%	**1.74 (1.50 to 1.98)**	**1.68 (1.39 to 1.96)**	**1.63 (1.42 to 1.83)**	**1.72 (1.54 to 1.91)**

5.4.1 Descriptive Results

At the national level, 12.1% of Canadians had an MD, 8.0% had an AD, 20.0% had a SUD, and 30.8% had Any Mental or Substance Disorder.

The observed frequencies of Social Determinants are found in Table 5.1. The majority of respondents were between the ages of 25-44 (35.8%), female (50.7%), had a post-secondary level education(60.9%), were employed in the last 2 weeks (69.2%), were a non-immigrant (66.6%), white (69.7%), married or common law (57.2%), living as a couple with children (43.4%), had a chronic condition (55.8%), were heterosexual (97.7%) with flourishing mental health (76.2%) and a strong sense of community belonging (61.5%).
Not listed in the table to increase its clarity, 24.2% of respondents lived in the Toronto CMA.

5.4.2 Simple Logistic Regression Analysis

The interaction between covariates and the mental health outcomes of MD and AD were similar to each other but differed from the interactions between the covariates and SUD. Due to the nature of its construction, the interaction between the Any Mental or Substance Disorder outcome and covariate was between the other three outcomes.

5.4.2.1 Demographics

Older age (65+) has a significantly lower odds of having an MD (OR 0.51), AD (OR 0.72) SUD (OR 0.48), or Any Mental or Substance Disorder (OR 0.56). There was only one other statistically significant difference between the reference group and the other age groups in any of the disorders (individuals aged 15-24 had a lower odds of having an AD than those aged 25-44).

Females, compared to males, had higher odds of having MD (OR 1.48) and AD (OR 1.88), but a lower odds of having an SUD (OR 0.32), or Any Mental or Substance Disorder (OR 0.64).

5.4.2.2 Socioeconomic Status

Results varied among measures of socioeconomic status and type of mental health disorder.

The poorest neighbourhoods and individuals, and unemployed individuals had higher odds of MD and AD compared to the richest neighbourhood or individuals and employed individuals. Individuals who reported having some post-secondary education had higher odds (OR 1.57) of having an MD compared to individuals reporting post-secondary school graduation. There was no significant difference between levels of education when predicting AD.

There was little significant difference in the ORs comparing levels of neighbourhood income when predicting SUD. However, poorer individuals had lower odds of having an SUD than the richest individuals when comparing the poorest (OR 0.62), 2nd (OR 0.55), 3rd (OR 0.81) and 4th (OR 0.91) quintiles to the richest quintile. Unemployed individuals also had lower odds (OR 0.67) of having a SUD compared to employed individuals. Individuals who reported some post-secondary school or secondary school graduation had higher odds of having an SUD than individuals who reported post-secondary school graduation (OR 1.52 and 1.22, respectively).

5.4.2.3 Culture

The effects of culture were consistent across the types of mental health disorder.

Immigrants of any duration of stay in Canada, compared to non-immigrants, had lower odds of having MD, AD, SUD or Any Mental or Substance Disorder.

In general, individuals who reported white ethnicity had higher odds of having a mental disorder than those who reported a non-white ethnicity. For example, individuals who reported Asian Ethnicity had significantly lower odds of MD (OR 0.50), AD (OR 0.49), SUD(OR 0.16) or Any Mental or Substance Disorder (OR 0.25), compared to individuals who reported white ethnicity. The exception was individuals who reported Aboriginal ethnicity. Those who reported Aboriginal ethnicity had higher odds of MD (OR 1.47), AD (OR 1.76), SUD (OR 2.63) or Any Mental or Substance Disorder (OR 2.49), compared to individuals who reported white ethnicity.

5.4.2.4 Homelife

In general, compared to individuals who reported being married or in a common-law relationship, individuals who reported being widowed, separated, or divorced, or those who reported being single, never married had higher odds of having an MD, AD or Any Mental or Substance Disorder. Individuals who were widowed, separated or divorced had lower odds of having an SUD than individuals who reported being married or in a common-law relationship.

Couples living alone typically had lower odds of having a mental health disorder than other household types. The exception was that couples with children had lower odds of having an AD (OR 0.60), or Any Mental or Substance Disorder (0.83) than couples living alone.

5.4.2.5 Other

Individuals who reported having a chronic condition had significantly greater odds of having any of the reported disorders. This discrepancy was highest in AD, where individuals who reported having a chronic condition had 4.84 times greater odds of having an AD than individuals who did not report having a chronic condition.

Individuals who reported they were homosexual or bisexual also had significantly greater odds of having any of the reported disorders. Individuals who reported being either homosexual or bisexual had 3.78 times the odds of having Any Mental or Substance Disordercompared to heterosexual individuals.

5.4.2.6 Mental Health

Finally, individuals with flourishing mental health and a strong sense of community belonging had significantly lower odds of having any of the reported disorders than individuals with languishing and moderate mental health or a weak sense of community belonging.

5.4.3 Multiple Logistic Regression Analysis

5.4.3.1 Mood Disorder

Table 5.2 shows the stepwise addition of categories of variables in the model describing MD.

The first model includes only the demographic variables of age, sex, CMA, and neighbourhood income. Age and sex were robustly statistically significant across all the models-individuals who reported they were 65+ and male had statistically significantly lower odds of having an MD. The odds of having an MD was higher in the poorest neighbourhoods compared to the richest neighbourhoods. However, this effect was only statistically significant in the first three models, after the addition of homelife variables, the effect of neighbourhood income on the odds of having an MD could be explained by other variables. CMA was also included in all the

Table 5.2: Multiple Logistic Regression Models: OR of reporting Mood Disorder by Sociodemographic and Lifestyle Characteristics, Urban Canada 2012

	OR of reporting Mood Disorder (95% CI)						
Variable	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
age							
25-44	1	1	1	1	1	1	1
15-24	1.05 (0.84 to 1.27)	0.95 (0.72 to 1.18)	0.91 (0.69 to 1.13)	0.88 (0.61 to 1.16)	1.04 (0.78 to 1.30)	1.08 (0.81 to 1.35)	0.95 (0.65 to 1.25)
45-64	1.00 (0.82 to 1.17)	1.01 (0.83 to 1.18)	0.96 (0.78 to 1.14)	0.90 (0.71 to 1.08)	0.84 (0.68 to 1.00)	0.85 (0.69 to 1.02)	0.79 (0.62 to 0.96)
65+	**0.50 (0.39 to 0.61)**	**0.58 (0.42 to 0.74)**	**0.53 (0.37 to 0.69)**	**0.45 (0.30 to 0.60)**	**0.42 (0.29 to 0.55)**	**0.51 (0.34 to 0.67)**	0.37 (0.24 to 0.49)
sex							
male	1	1	1	1	1	1	1
female	**1.51 (1.27 to 1.75)**	**1.44 (1.21 to 1.67)**	**1.41 (1.18 to 1.64)**	**1.42 (1.18 to 1.65)**	**1.31 (1.09 to 1.53)**	**1.43 (1.18 to 1.67)**	1.41 (0.99 to 1.83)
neighbouhood income							
richest	1	1	1	1	1	1	1
4	1.11 (0.82 to 1.39)	1.08 (0.80 to 1.37)	1.08 (0.79 to 1.37)	1.04 (0.77 to 1.32)	1.04 (0.75 to 1.32)	1.07 (0.76 to 1.38)	1.01 (0.73 to 1.29)
3	1.17 (0.89 to 1.45)	1.12 (0.84 to 1.40)	1.15 (0.86 to 1.44)	1.08 (0.80 to 1.35)	1.09 (0.80 to 1.38)	1.15 (0.82 to 1.48)	1.03 (0.76 to 1.31)
2	1.09 (0.84 to 1.35)	1.03 (0.78 to 1.29)	1.05 (0.79 to 1.32)	0.96 (0.72 to 1.21)	0.98 (0.72 to 1.24)	0.92 (0.66 to 1.18)	0.91 (0.67 to 1.16)
poorest	**1.51 (1.16 to 1.87)**	**1.36 (1.01 to 1.70)**	**1.47 (1.08 to 1.85)**	1.25 (0.92 to 1.58)	1.33 (0.97 to 1.70)	1.28 (0.91 to 1.66)	1.18 (0.86 to 1.51)
individual income							
richest		1	1	1	1	1	1
4		1.09 (0.80 to 1.37)	1.16 (0.85 to 1.47)	1.17 (0.85 to 1.49)	1.15 (0.83 to 1.46)	1.10 (0.78 to 1.43)	1.15 (0.83 to 1.46)
3		**1.43 (1.09 to 1.77)**	**1.63 (1.22 to 2.03)**	**1.63 (1.22 to 2.04)**	**1.61 (1.20 to 2.02)**	**1.47 (1.08 to 1.87)**	1.60 (1.19 to 2.02)
2		1.23 (0.90 to 1.56)	**1.45 (1.05 to 1.85)**	**1.44 (1.04 to 1.84)**	**1.40 (1.00 to 1.79)**	1.28 (0.91 to 1.65)	1.39 (1.00 to 1.78)
poorest		1.34 (0.99 to 1.69)	**1.73 (1.26 to 2.21)**	**1.68 (1.22 to 2.15)**	**1.60 (1.15 to 2.05)**	1.38 (0.98 to 1.78)	1.55 (1.11 to 1.99)
education							
post-secondary graduation		1	1	1	1	1	1
some post-secondary		**1.44 (1.04 to 1.84)**	1.27 (0.91 to 1.64)	1.23 (0.87 to 1.59)	1.20 (0.84 to 1.55)	1.14 (0.81 to 1.48)	1.14 (0.80 to 1.48)
secondary school graduation		0.94 (0.74 to 1.13)	0.84 (0.67 to 1.02)	0.85 (0.67 to 1.03)	0.86 (0.68 to 1.03)	0.84 (0.66 to 1.03)	0.86 (0.68 to 1.04)
less than secondary school graduation		0.86 (0.65 to 1.06)	**0.75 (0.56 to 0.93)**	**0.76 (0.58 to 0.95)**	**0.74 (0.55 to 0.92)**	**0.72 (0.54 to 0.90)**	0.72 (0.53 to 0.91)
employment							
employed in last 2 weeks		1	1	1	1	1	1
unemployed in last 2 weeks		**1.24 (1.00 to 1.48)**	**1.26 (1.02 to 1.50)**	1.23 (1.00 to 1.46)	1.15 (0.93 to 1.38)	1.03 (0.82 to 1.24)	1.13 (0.91 to 1.35)
immigrant length in Canada							
non-immigrant			1	1	1	1	1
0-2 years			**0.30 (0.09 to 0.50)**	**0.32 (0.10 to 0.53)**	**0.41 (0.12 to 0.69)**	**0.45 (0.13 to 0.77)**	0.43 (0.13 to 0.72)
3-10 years			**0.52 (0.30 to 0.73)**	**0.57 (0.32 to 0.81)**	**0.63 (0.36 to 0.90)**	0.71 (0.39 to 1.03)	0.68 (0.38 to 0.97)
11-20 years			**0.73 (0.45 to 1.00)**	0.81 (0.50 to 1.13)	0.79 (0.49 to 1.10)	0.85 (0.51 to 1.20)	0.88 (0.53 to 1.23)
21+ years			**0.69 (0.49 to 0.88)**	**0.69 (0.50 to 0.87)**	**0.70 (0.50 to 0.90)**	**0.78 (0.55 to 1.00)**	0.70 (0.50 to 0.89)
ethnicity							
white				1	1	1	1
black			1.01 (0.51 to 1.50)	1.03 (0.51 to 1.55)	1.08 (0.54 to 1.62)	0.99 (0.40 to 1.58)	1.10 (0.53 to 1.66)
asian			**0.59 (0.37 to 0.80)**	**0.62 (0.39 to 0.85)**	**0.70 (0.44 to 0.97)**	**0.69 (0.42 to 0.96)**	0.73 (0.45 to 1.01)
arab			0.90 (0.23 to 1.57)	1.04 (0.28 to 1.81)	1.13 (0.27 to 1.99)	1.14 (0.19 to 2.09)	1.25 (0.31 to 2.19)
latin american			1.12 (0.48 to 1.77)	1.19 (0.52 to 1.86)	1.02 (0.41 to 1.62)	0.99 (0.42 to 1.56)	1.08 (0.44 to 1.73)
aborigional			1.19 (0.71 to 1.66)	1.21 (0.72 to 1.70)	1.14 (0.68 to 1.60)	1.16 (0.66 to 1.66)	1.18 (0.69 to 1.66)

other or multiple	1.04 (0.51 to 1.57)	1.08 (0.53 to 1.62)	1.04 (0.50 to 1.58)	1.04 (0.55 to 1.53)	1.07 (0.51 to 1.62)
marital status					
married or common law		1			1
widowed, separated, or divorced		1.36 (0.88 to 1.83)			1.26 (0.63 to 1.89)
single never married		1.28 (0.84 to 1.72)			1.38 (0.76 to 1.99)
household type					
couple alone		1			1
individual alone		1.21 (0.79 to 1.64)			1.19 (0.62 to 1.76)
individual with children		0.77 (0.48 to 1.07)			1.20 (0.50 to 1.90)
couple with children		**0.71 (0.53 to 0.89)**			0.85 (0.53 to 1.17)
other		0.91 (0.55 to 1.28)			0.71 (0.32 to 1.10)
chronic conditions					
no chronic condition			1	1	1
chronic condition			**3.59 (2.90 to 4.28)**	**3.31 (2.67 to 3.95)**	3.53 (2.83 to 4.22)
sexuality					
heterosexual			1	1	1
homosexual or bisexual			**2.31 (1.57 to 3.04)**	**1.94 (1.30 to 2.57)**	1.85 (1.03 to 2.68)
mental health status					
flourishing mental health				1	
languishing mental health				**.77 (6.86 to 18.67)**	
moderate mental health				**2.82 (2.33 to 3.30)**	
sense of community belonging					
strong sense of community belonging				1	
weak sense of community belonging				1.15 (0.97 to 1.34)	
interaction of sex and marital status					
male and married or common law					1
female and widowed, separated, or div					1.24 (0.46 to 2.01)
female and single never married					0.98 (0.48 to 1.48)
interaction of sex and household type					
male and couple alone					1
female and individual alone					0.96 (0.40 to 1.52)
female and individual with children					0.51 (0.14 to 0.87)
female and couple with children					0.86 (0.45 to 1.27)
female and other					1.57 (0.41 to 2.73)
interaction of sex and sexuality					
male and heterosexual					1
female and homosexual or bisexual					1.34 (0.38 to 2.30)

models, though the ORs comparing other CMAs to the reference CMA of Toronto were inconsistently statistically significant in predicting MD across various models.

The second model added indicators describing the individual socioeconomic status. Individual SES had mixed effects of predicting MDs. Individual income was robust in predicting MD, but interestingly, only the middle quintile (compared to the richest quintile) was consistent in statistically significantly increasing the odds of having an MD. The other 3 quintiles had consistently higher OR compared to the richest quintile, but were not always statistically significant. With the exception of one model, education was also a robust indicator, individuals who reported less than secondary school graduation had a lower odds of having a MD than those who had completed post-secondary graduation. However, employment status did not statistically significantly contribute to the prediction of having an MD.

The addition of cultural specific variables was shown in the 3rd model. Immigration status, specifically the comparison between immigrants who had lived in Canada for 0-10 years or 21+ years compared to non-immigrants was statistically significant in predicting MD. Only one category of ethnicity was significantly different than individuals who reported white ethnicity; individuals who reported asian ethnicity had lower odds of having an MD (OR 0.59-0.70).

The addition of homelife-related variables had very little effect on the prediction of MD (model 4). Marital status was not statistically significant in predicting MD, and only one category of household type was different from the reference category (couple alone).

Next, chronic conditions and sexuality were added to the model. Both of these variables had a statistically significant effect on the prediction of MD (model 5). The odds of having a MD was 3.59 times higher in the group with chronic conditions compared to the group without chronic conditions, and 2.3 times higher in the group who reported being homosexual or bisexual compared to the group who reported being heterosexual. This model was considered the final model.

Model 6 shows the effect of the addition of the mental health variables mental health status and sense of community belonging. Both variables were statistically significant. However, these variables were effect mediators for the variables already in the model, so were not included in the final model.

Model 7 shows the effect of including homelife variables, and the interaction between sex and homelife variables. The addition of the interaction variables was also mostly statistically non-significant and had very little effect on the OR of the variables already in the model. So in order to produce the most parsimonious model, homelife-related variables were excluded from subsequent models.

Therefore, the final model predicting MD included the variables that described demographics, individual SES, culture, and other, that were made up of the individual variables age, sex, CMA, neighbourhood income, individual income, education, employment, immigrant length in Canada, ethnicity, chronic conditions and sexuality.

5.4.3.2 Anxiety Disorder

Table 5.3 shows the stepwise addition of categories of variables in the model describing AD.

Model one includes only demographic variables- age, sex, CMA and neighbourhood income. Age and sex were robust variables- individuals ages between 15-24 or over 65+ and males had much lower odds of having an AD than those aged 25-44 and female. There was

Table 5.3: Multiple Logistic Regression Models: OR of reporting Anxiety Disorder by Sociodemographic and Lifestyle Characteristics, Urban Canada 2012

	OR of reporting Anxiety Disorder (95% CI)							
Variable	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
age								
25-44	1	1	1	1	1	1	1	1
15-24	**0.73 (0.54 to 0.93)**	**0.64 (0.45 to 0.83)**	**0.61 (0.43 to 0.80)**	**0.57 (0.36 to 0.78)**	**0.65 (0.41 to 0.90)**	**0.70 (0.44 to 0.95)**	**0.65 (0.40 to 0.89)**	0.64 (0.40 to 0.89)
45-64	1.16 (0.94 to 1.39)	1.14 (0.91 to 1.37)	1.07 (0.85 to 1.29)	0.99 (0.77 to 1.21)	0.89 (0.68 to 1.09)	0.91 (0.70 to 1.12)	0.88 (0.68 to 1.08)	0.88 (0.68 to 1.09)
65+	**0.68 (0.51 to 0.85)**	**0.68 (0.47 to 0.89)**	**0.61 (0.41 to 0.81)**	**0.49 (0.32 to 0.67)**	**0.42 (0.27 to 0.56)**	**0.51 (0.33 to 0.69)**	**0.41 (0.27 to 0.56)**	0.42 (0.27 to 0.56)
sex								
male	1	1	1	1	1	1	1	1
female	**1.90 (1.57 to 2.24)**	**1.83 (1.50 to 2.17)**	**1.83 (1.49 to 2.17)**	**1.84 (1.50 to 2.19)**	**1.70 (1.37 to 2.02)**	**1.84 (1.50 to 2.19)**	**2.05 (1.33 to 2.76)**	2.02 (1.32 to 2.73)
neighbouhood income								
richest	1	1	1	1	1	1	1	1
4	1.06 (0.73 to 1.40)	1.14 (0.77 to 1.52)	1.16 (0.77 to 1.55)	1.09 (0.73 to 1.46)	1.06 (0.70 to 1.43)	1.10 (0.72 to 1.48)	1.07 (0.70 to 1.44)	1.06 (0.70 to 1.43)
3	0.98 (0.70 to 1.26)	1.01 (0.71 to 1.31)	1.06 (0.75 to 1.37)	0.99 (0.70 to 1.29)	0.95 (0.66 to 1.24)	1.00 (0.68 to 1.32)	0.95 (0.66 to 1.24)	0.95 (0.66 to 1.24)
2	1.12 (0.83 to 1.41)	1.13 (0.82 to 1.44)	1.19 (0.86 to 1.52)	1.10 (0.79 to 1.41)	1.04 (0.73 to 1.35)	1.02 (0.71 to 1.33)	1.05 (0.73 to 1.36)	1.04 (0.73 to 1.35)
poorest	**1.39 (1.02 to 1.76)**	1.32 (0.94 to 1.71)	**1.52 (1.08 to 1.95)**	1.32 (0.93 to 1.70)	1.23 (0.85 to 1.60)	1.22 (0.83 to 1.61)	1.23 (0.86 to 1.60)	1.22 (0.85 to 1.59)
individual income								
richest		1	1	1	1	1	1	1
4		1.08 (0.74 to 1.41)	1.16 (0.80 to 1.52)	1.17 (0.81 to 1.54)	1.15 (0.79 to 1.51)	1.09 (0.73 to 1.45)	1.14 (0.78 to 1.50)	1.15 (0.79 to 1.51)
3		0.86 (0.62 to 1.10)	1.02 (0.74 to 1.30)	1.05 (0.76 to 1.34)	1.02 (0.72 to 1.31)	0.93 (0.66 to 1.20)	1.01 (0.71 to 1.30)	1.01 (0.72 to 1.31)
2		0.95 (0.63 to 1.27)	1.20 (0.80 to 1.61)	1.23 (0.81 to 1.64)	1.16 (0.76 to 1.56)	1.05 (0.69 to 1.41)	1.15 (0.75 to 1.55)	1.16 (0.76 to 1.56)
poorest		1.14 (0.78 to 1.50)	**1.62 (1.09 to 2.15)**	**1.61 (1.10 to 2.12)**	1.46 (0.98 to 1.94)	1.24 (0.83 to 1.65)	1.46 (0.97 to 1.94)	1.47 (0.99 to 1.96)
education								
post-secondary graduation		1	1	1	1	1	1	1
some post-secondary		1.49 (1.00 to 1.98)	1.26 (0.83 to 1.69)	1.21 (0.79 to 1.63)	1.11 (0.72 to 1.51)	1.11 (0.73 to 1.49)	1.11 (0.71 to 1.50)	1.11 (0.71 to 1.50)
secondary school graduation		1.04 (0.77 to 1.31)	0.91 (0.66 to 1.15)	0.91 (0.66 to 1.16)	0.93 (0.67 to 1.19)	0.94 (0.68 to 1.20)	0.92 (0.67 to 1.18)	0.92 (0.67 to 1.18)
less than secondary school graduation		0.87 (0.62 to 1.12)	**0.74 (0.52 to 0.96)**	**0.76 (0.53 to 0.99)**	**0.75 (0.52 to 0.98)**	**0.75 (0.52 to 0.97)**	**0.74 (0.52 to 0.97)**	0.75 (0.52 to 0.97)
employment								
employed in last 2 weeks		1	1	1	1	1	1	1
unemployed in last 2 weeks		**1.50 (1.19 to 1.81)**	**1.50 (1.18 to 1.81)**	**1.46 (1.15 to 1.76)**	**1.31 (1.03 to 1.59)**	1.16 (0.90 to 1.41)	**1.32 (1.03 to 1.61)**	1.31 (1.03 to 1.59)
immigrant length in Canada								
non-immigrant			1	1	1	1	1	1
0-2 years			**0.22 (0.00 to 0.44)**	**0.24 (0.00 to 0.49)**	**).36 (-0.01 to 0.73)**	**).39 (-0.01 to 0.79)**	**).36 (-0.01 to 0.73)**	).36 (-0.01 to 0.73)
3-10 years			**0.35 (0.13 to 0.57)**	**0.39 (0.14 to 0.64)**	**0.49 (0.17 to 0.81)**	**0.49 (0.15 to 0.83)**	**0.48 (0.17 to 0.80)**	0.49 (0.17 to 0.80)
11-20 years			**0.54 (0.26 to 0.82)**	**0.63 (0.30 to 0.96)**	0.67 (0.30 to 1.04)	0.69 (0.31 to 1.08)	0.67 (0.31 to 1.03)	0.67 (0.30 to 1.03)
21+ years			**0.64 (0.43 to 0.84)**	**0.65 (0.44 to 0.85)**	**0.65 (0.44 to 0.85)**	**0.71 (0.48 to 0.94)**	**0.64 (0.44 to 0.85)**	0.64 (0.44 to 0.85)
ethnicity								
white			1	1	1	1	1	1
black			**0.54 (0.15 to 0.92)**	**0.53 (0.16 to 0.90)**	**0.55 (0.16 to 0.94)**	**0.46 (0.12 to 0.80)**	**0.56 (0.16 to 0.95)**	0.55 (0.16 to 0.95)
asian			**0.56 (0.33 to 0.78)**	**0.57 (0.34 to 0.80)**	**0.70 (0.41 to 0.99)**	**0.69 (0.41 to 0.98)**	**0.70 (0.41 to 0.99)**	0.70 (0.41 to 1.00)
arab			1.05 (0.10 to 2.00)	1.17 (0.12 to 2.22)	1.43 (0.09 to 2.77)	1.32 (-0.06 to 2.71)	1.38 (0.08 to 2.69)	1.41 (0.09 to 2.73)
latin american			**).41 (-0.03 to 0.84)**	**).41 (-0.03 to 0.85)**	**).40 (-0.03 to 0.83)**	**).35 (-0.05 to 0.75)**	**).41 (-0.03 to 0.84)**	).41 (-0.03 to 0.85)
aborigional			1.40 (0.92 to 1.89)	1.41 (0.92 to 1.91)	1.38 (0.89 to 1.87)	1.40 (0.89 to 1.91)	1.38 (0.89 to 1.87)	1.38 (0.89 to 1.87)

other or multiple	0.59 (0.18 to 1.00)	0.60 (0.18 to 1.01)	0.60 (0.16 to 1.03)	0.61 (0.18 to 1.03)	0.59 (0.17 to 1.02)	0.60 (0.17 to 1.02)
marital status						
married or common law		1	1	1	1	1
widowed, separated, or divorced		1.66 (0.97 to 2.34)	**1.73 (1.01 to 2.44)**	1.58 (0.91 to 2.24)	1.05 (0.38 to 1.73)	1.75 (1.03 to 2.47)
single never married		1.45 (0.90 to 1.99)	1.46 (0.90 to 2.02)	1.26 (0.78 to 1.74)	1.16 (0.51 to 1.81)	1.46 (0.89 to 2.02)
household type						
couple alone		1	1	1	1	1
individual alone		0.77 (0.45 to 1.09)	0.74 (0.43 to 1.04)	0.75 (0.44 to 1.07)	1.16 (0.40 to 1.91)	0.85 (0.40 to 1.30)
individual with children		**0.63 (0.36 to 0.90)**	**0.67 (0.37 to 0.96)**	0.74 (0.41 to 1.07)	1.16 (0.27 to 2.04)	0.87 (0.30 to 1.44)
couple with children		**0.60 (0.43 to 0.77)**	**0.66 (0.47 to 0.85)**	**0.70 (0.49 to 0.91)**	0.84 (0.46 to 1.22)	0.78 (0.44 to 1.13)
other		**0.60 (0.29 to 0.92)**	**0.58 (0.27 to 0.89)**	**0.62 (0.28 to 0.96)**	0.70 (0.14 to 1.27)	0.57 (0.14 to 1.00)
chronic conditions						
no chronic condition			1	1	1	1
chronic condition			**4.37 (3.30 to 5.44)**	**3.98 (2.99 to 4.96)**	**4.38 (3.32 to 5.45)**	4.37 (3.30 to 5.44)
sexuality						
heterosexual			1	1	1	1
homosexual or bisexual			**2.42 (1.45 to 3.39)**	**2.10 (1.20 to 3.01)**	**2.78 (1.26 to 4.30)**	2.43 (1.44 to 3.42)
mental health status						
flourishing mental health				1		
languishing mental health				**.10 (5.34 to 14.87)**		
moderate mental health				**2.59 (2.06 to 3.13)**		
sense of community belonging						
strong sense of community belonging				1		
weak sense of community belonging				1.06 (0.84 to 1.28)		
interaction of sex and marital status						
male and married or common law					1	
female and widowed, separated, or div					2.14 (0.38 to 3.90)	
female and single never married					1.44 (0.48 to 2.40)	
interaction of sex and household type						
male and couple alone					1	1
female and individual alone					**0.48 (0.10 to 0.86)**	0.78 (0.44 to 1.13)
female and individual with children					**0.42 (0.02 to 0.81)**	0.68 (0.23 to 1.13)
female and couple with children					0.68 (0.33 to 1.04)	0.77 (0.39 to 1.15)
female and other					0.75 (0.00 to 1.50)	1.05 (0.16 to 1.95)
interaction of sex and sexuality						
male and heterosexual					1	
female and homosexual or bisexual					0.75 (0.17 to 1.33)	

limited statistical significant difference between the OR of having an AD in Toronto compared to other CMAs in the first two models, and that statistical significance was entirely explained by other variables after the addition of cultural variables in the 3rd model. The OR comparing neighbourhood income quintiles similarly had reduced statistically significant difference after subsequent additions of variables explaining individual SES and homelife.

Individual-level SES was added to the second model. Though there was limited statistically significant difference in the OR comparing individual levels of SES in the second model, the addition of other variables in subsequent models increased the amount of statistically significant difference between SES levels, particularly for the education and employment variables. Individuals who reported less than secondary school graduation had statistically significantly lower odds of an AD in models that included at least demographics, individual SES and cultural variables. Individuals who reported they were unemployed in the last two weeks had higher odds of having an AD than those who reported they were employed in the last two weeks. Contrarily, individual SES when included with other SES variables had little impact on the odds of AD.

Culture was a robust set of variables in predicting the likelihood of an AD (Model 3). There was a graded increase in the odds of having an AD and the number of years that the individual had been in Canada, in that individuals who had been in Canada for the least amount of years had lower odds of having an AD than those who had been in Canada longer, who in turn had a lower odds of having an AD than those who were not immigrants to Canada. This effect was maintained across all the models in which the immigration variable was included. Ethnicity also had a statistically significant effect on predicting AD- individuals who reported black, asian or latin american ethnicity had lower odds of having an AD than those who reported white ethnicity.

Model 4 included homelife variables. The effect of marital status was present, but not consistently statistically significant at the 95% CI. The odds of having an AD were higher amongst individuals who were widowed, separated or divorced compared to those who were married. The household type was individually statistically significant in models where it was not included in an interaction term. Couples living with children or individuals living in "other" household types had lower odds of having an AD than couples who lived alone. As seen in Models 7 and 8, the interaction terms including these variables were not statistically significant when included in a model with all the interaction terms (marital status and sex), or when included as the only interaction term (household type and sex). Therefore, to create an increasingly parsimonious model, the interaction terms were not included in the final model.

The addition of chronic conditions and sexuality, as seen in Model 5, were statistically significant. Individuals with chronic conditions and those who reported being homosexual or bisexual had greater odds of having an AD compared to individuals without chronic conditions and those who reported being heterosexual.

The addition of mental health variables, as shown in model 6, showed that these variables were significant in predicting the likelihood of having an AD. However, the mental health variables were effect mediators, and thus excluded from subsequent models.

The final model, model 5, predicting AD included age, sex, CMA, neighbourhood income, individual income, education employment, immigration, ethnicity, marital status, household type, chronic condition and sexuality. These variables represent the demographics, individual SES, culture, home life, and other categories.

Table 5.4: Multiple Logistic Regression Models: OR of reporting Substance Use Disorder by Sociodemographic and Lifestyle Characteristics, Urban Canada 2012

	OR of reporting Substance Use Disorder (95% CI)							
Variable	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
age								
25-44	1	1	1	1	1	1	1	1
15-24	**0.85 (0.70 to 1.00)**	**0.79 (0.63 to 0.96)**	**0.73 (0.58 to 0.88)**	0.82 (0.60 to 1.04)	0.86 (0.63 to 1.08)	0.86 (0.64 to 1.09)	0.86 (0.64 to 1.07)	0.85 (0.63 to 1.07)
45-64	0.89 (0.75 to 1.03)	0.86 (0.72 to 1.00)	**0.81 (0.66 to 0.95)**	**0.83 (0.67 to 1.00)**	**0.81 (0.65 to 0.97)**	**0.82 (0.66 to 0.98)**	**0.82 (0.65 to 0.98)**	**0.81 (0.65 to 0.97)**
65+	**0.48 (0.39 to 0.57)**	**0.70 (0.52 to 0.87)**	**0.60 (0.44 to 0.77)**	**0.66 (0.46 to 0.86)**	**0.62 (0.43 to 0.81)**	**0.69 (0.48 to 0.90)**	**0.68 (0.48 to 0.89)**	**0.68 (0.48 to 0.89)**
sex								
male	1	1	1	1	1	1	1	1
female	**0.32 (0.27 to 0.36)**	**0.33 (0.29 to 0.38)**	**0.30 (0.26 to 0.35)**	**0.31 (0.27 to 0.36)**	**0.29 (0.25 to 0.34)**	**0.29 (0.25 to 0.34)**	**0.32 (0.24 to 0.40)**	**0.33 (0.25 to 0.41)**
neighbouhood income								
richest	1	1	1	1	1	1	1	1
4	0.92 (0.71 to 1.12)	0.96 (0.74 to 1.18)	0.98 (0.76 to 1.20)	0.98 (0.76 to 1.21)	0.96 (0.74 to 1.19)	0.97 (0.74 to 1.19)	0.95 (0.73 to 1.18)	0.96 (0.73 to 1.19)
3	0.97 (0.76 to 1.18)	1.02 (0.80 to 1.24)	1.06 (0.84 to 1.28)	1.02 (0.80 to 1.23)	1.00 (0.78 to 1.21)	0.99 (0.77 to 1.21)	0.98 (0.76 to 1.20)	0.99 (0.77 to 1.21)
2	1.23 (0.97 to 1.49)	**1.38 (1.07 to 1.68)**	**1.47 (1.15 to 1.79)**	**1.37 (1.07 to 1.67)**	**1.35 (1.05 to 1.64)**	**1.31 (1.02 to 1.60)**	**1.31 (1.02 to 1.60)**	**1.32 (1.02 to 1.61)**
poorest	1.00 (0.79 to 1.21)	1.19 (0.92 to 1.46)	**1.43 (1.11 to 1.75)**	1.30 (1.00 to 1.60)	1.24 (0.95 to 1.53)	1.19 (0.91 to 1.48)	1.18 (0.90 to 1.47)	1.19 (0.90 to 1.47)
individual income								
richest		1	1	1	1	1	1	1
4		0.87 (0.69 to 1.04)	1.00 (0.79 to 1.20)	1.00 (0.79 to 1.21)	1.00 (0.79 to 1.21)	0.98 (0.77 to 1.20)	0.96 (0.75 to 1.17)	0.96 (0.76 to 1.17)
3		**0.83 (0.65 to 1.00)**	1.05 (0.82 to 1.28)	1.04 (0.81 to 1.27)	1.03 (0.79 to 1.26)	0.98 (0.75 to 1.21)	0.96 (0.74 to 1.18)	0.95 (0.73 to 1.17)
2		**0.54 (0.42 to 0.65)**	**0.77 (0.60 to 0.94)**	**0.74 (0.57 to 0.90)**	**0.73 (0.56 to 0.89)**	**0.70 (0.53 to 0.86)**	**0.69 (0.53 to 0.85)**	**0.68 (0.52 to 0.85)**
poorest		**0.65 (0.49 to 0.80)**	1.08 (0.81 to 1.35)	0.97 (0.73 to 1.21)	0.93 (0.69 to 1.17)	0.86 (0.63 to 1.09)	0.83 (0.61 to 1.05)	0.83 (0.61 to 1.05)
education								
post-secondary graduation		1	1	1	1	1	1	1
some post-secondary		**1.73 (1.25 to 2.20)**	**1.44 (1.06 to 1.82)**	**1.49 (1.10 to 1.87)**	**1.43 (1.05 to 1.81)**	**1.39 (1.01 to 1.78)**	**1.41 (1.02 to 1.79)**	**1.40 (1.01 to 1.78)**
secondary school graduation		**1.34 (1.10 to 1.58)**	1.14 (0.93 to 1.36)	1.17 (0.95 to 1.39)	1.21 (0.98 to 1.44)	1.21 (0.98 to 1.45)	1.22 (0.98 to 1.46)	1.22 (0.98 to 1.46)
less than secondary school graduation		1.16 (0.90 to 1.42)	0.93 (0.72 to 1.15)	1.01 (0.78 to 1.25)	1.03 (0.80 to 1.27)	1.06 (0.82 to 1.31)	1.06 (0.82 to 1.31)	1.07 (0.82 to 1.31)
employment								
employed in last 2 weeks		1	1	1	1	1	1	1
unemployed in last 2 weeks		0.88 (0.73 to 1.04)	0.86 (0.70 to 1.02)	0.87 (0.71 to 1.03)	**0.83 (0.67 to 0.98)**	**0.79 (0.64 to 0.94)**	**0.81 (0.65 to 0.97)**	**0.82 (0.66 to 0.98)**
immigrant length in Canada								
non-immigrant			1	1	1	1	1	1
0-2 years			**0.42 (0.16 to 0.68)**	**0.41 (0.16 to 0.67)**	**0.48 (0.18 to 0.78)**	**0.52 (0.20 to 0.84)**	**0.51 (0.20 to 0.83)**	**0.52 (0.20 to 0.83)**
3-10 years			**0.29 (0.17 to 0.41)**	**0.31 (0.19 to 0.44)**	**0.33 (0.20 to 0.47)**	**0.34 (0.20 to 0.48)**	**0.33 (0.20 to 0.47)**	**0.33 (0.20 to 0.47)**
11-20 years			**0.20 (0.10 to 0.29)**	**0.20 (0.11 to 0.30)**	**0.20 (0.11 to 0.30)**	**0.20 (0.11 to 0.30)**	**0.21 (0.11 to 0.30)**	**0.20 (0.11 to 0.30)**
21+ years			**0.56 (0.41 to 0.71)**	**0.56 (0.41 to 0.72)**	**0.56 (0.40 to 0.72)**	**0.58 (0.42 to 0.74)**	**0.57 (0.41 to 0.72)**	**0.57 (0.41 to 0.72)**
ethnicity								
white			1	1	1	1	1	1
black			**0.43 (0.21 to 0.65)**	**0.43 (0.21 to 0.66)**	**0.46 (0.22 to 0.69)**	**0.47 (0.23 to 0.72)**	**0.47 (0.22 to 0.71)**	**0.47 (0.22 to 0.72)**
asian			**0.26 (0.17 to 0.34)**	**0.26 (0.17 to 0.35)**	**0.28 (0.18 to 0.37)**	**0.28 (0.18 to 0.37)**	**0.28 (0.18 to 0.38)**	**0.28 (0.19 to 0.38)**
arab			**).10 (-0.02 to 0.22)**	**).10 (-0.03 to 0.23)**	**).13 (-0.03 to 0.30)**	**).14 (-0.03 to 0.32)**	**).14 (-0.03 to 0.31)**	**).14 (-0.03 to 0.31)**
latin american			1.00 (0.50 to 1.50)	1.01 (0.50 to 1.53)	1.02 (0.49 to 1.55)	1.05 (0.50 to 1.60)	1.09 (0.53 to 1.65)	1.09 (0.53 to 1.65)
aborigional			**2.00 (1.41 to 2.59)**	**1.96 (1.37 to 2.55)**	**1.93 (1.33 to 2.53)**	**1.96 (1.33 to 2.58)**	**1.92 (1.31 to 2.53)**	**1.91 (1.31 to 2.52)**

other or multiple	0.71 (0.39 to 1.03)	0.70 (0.39 to 1.01)	0.72 (0.40 to 1.04)	0.72 (0.40 to 1.03)	**0.69 (0.39 to 0.99)**	**0.69 (0.39 to 0.99)**
marital status						
married or common law		1	1	1	1	1
widowed, separated, or divorced		**0.58 (0.39 to 0.77)**	**0.57 (0.38 to 0.76)**	**0.57 (0.38 to 0.76)**	**0.61 (0.35 to 0.88)**	**0.62 (0.35 to 0.88)**
single never married		**0.77 (0.56 to 0.98)**	**0.75 (0.55 to 0.96)**	**0.73 (0.54 to 0.93)**	**0.57 (0.38 to 0.75)**	**0.56 (0.37 to 0.74)**
household type						
couple alone		1	1	1	1	1
individual alone		**2.16 (1.49 to 2.84)**	**2.23 (1.54 to 2.93)**	**2.22 (1.52 to 2.92)**	**2.56 (1.55 to 3.56)**	**2.55 (1.54 to 3.56)**
individual with children		**1.78 (1.18 to 2.39)**	**1.93 (1.27 to 2.58)**	**1.93 (1.27 to 2.59)**	**2.11 (1.11 to 3.10)**	**2.14 (1.13 to 3.16)**
couple with children		1.11 (0.87 to 1.36)	1.20 (0.93 to 1.46)	1.24 (0.96 to 1.52)	**1.50 (1.08 to 1.92)**	**1.52 (1.10 to 1.95)**
other		**2.34 (1.51 to 3.16)**	**2.31 (1.48 to 3.13)**	**2.39 (1.51 to 3.26)**	**2.77 (1.45 to 4.10)**	**2.76 (1.43 to 4.09)**
chronic conditions						
no chronic condition			1	1	1	1
chronic condition			**1.59 (1.34 to 1.83)**	**1.50 (1.27 to 1.73)**	**1.52 (1.28 to 1.75)**	**1.51 (1.28 to 1.75)**
sexuality						
heterosexual			1	1	1	1
homosexual or bisexual			**2.47 (1.57 to 3.38)**	**2.28 (1.46 to 3.10)**	1.53 (0.84 to 2.23)	**2.26 (1.46 to 3.05)**
mental health status						
flourishing mental health				1	1	1
languishing mental health				**2.08 (1.15 to 3.01)**	**2.07 (1.14 to 2.99)**	**2.07 (1.13 to 3.00)**
moderate mental health				**1.71 (1.43 to 1.99)**	**1.68 (1.41 to 1.95)**	**1.69 (1.41 to 1.96)**
sense of community belonging						
strong sense of community belonging				1	1	1
weak sense of community belonging				**1.23 (1.06 to 1.41)**	**1.24 (1.06 to 1.42)**	**1.24 (1.06 to 1.42)**
interaction of sex and marital status						
male and married or common law					1	1
female and widowed, separated, or div					1.00 (0.40 to 1.60)	1.00 (0.39 to 1.60)
female and single never married					**2.14 (1.19 to 3.09)**	**2.24 (1.24 to 3.24)**
interaction of sex and household type						
male and couple alone					1	1
female and individual alone					0.64 (0.29 to 1.00)	**0.64 (0.28 to 0.99)**
female and individual with children					0.71 (0.22 to 1.20)	0.69 (0.21 to 1.16)
female and couple with children					**0.57 (0.32 to 0.81)**	**0.55 (0.31 to 0.78)**
female and other					0.63 (0.16 to 1.09)	0.64 (0.17 to 1.11)
interaction of sex and sexuality						
male and heterosexual					1	
female and homosexual or bisexual					2.55 (0.88 to 4.22)	

5.4.3.3 Substance Use Disorder

Table 5.4 shows the stepwise addition of categories of variables in the model describing SUD.

The first model is limited to age, sex, neighbourhood income quintile and CMA. Age, sex, and income all have robust effects that are maintained through all the subsequent models. The oldest age group (65+) maintains a lower odds of having a SUD as compared to the 25-44 year age group; females are less than one third as likely to have a SUD than males, and the second poorest income quintile is about 1.3 times as likely to have a SUD as the richest quintile.

The second model adds individual socioeconomic status variables. Similar to neighbourhood income quintiles, individuals in the second poorest income quintile are more likely to have a SUD than the richest quintile, individuals with some post-secondary school are more likely to have a SUD than those with post-secondary graduation. The effects of individual income quintile and education were robust; the OR comparing the SES variables were statistically significant in all of the subsequent models. There was little statistically significant difference between the levels of employment when considering SUD- there were a small increased odds of SUD among those employed compared to not employed in the last two weeks found in three of the seven models.

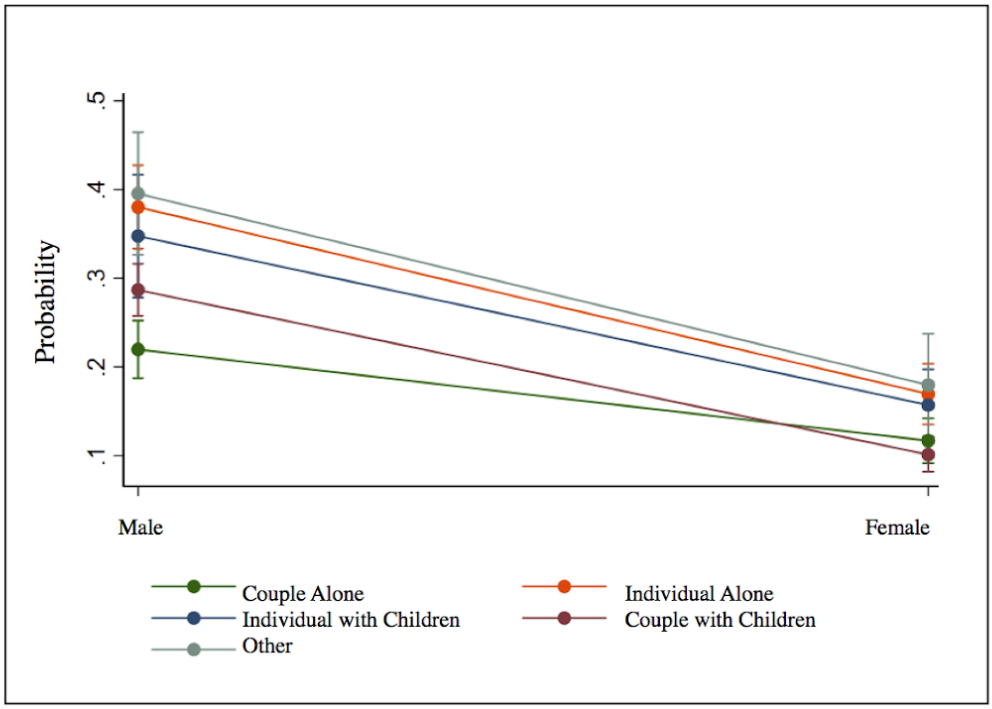
The third model showed the effect of adding the cultural variables of immigration status and ethnicity. Both variables were robust. Individuals who reported being an immigrant had statistically significantly lower odds of having a SUD than a non-immigrant. Immigrants who had lived in Canada for 11-20 years showed the lowest odds (OR 0.20-0.21) of having a SUD across all models. The impact of ethnicity on the prediction of SUD was also consistent across models. Individuals who had a black, asian, or arab ethnicity had lower odds of having an SUD compared to individuals with a white ethnicity (OR 0.43-0.47, 0.26-0.28, 0.10-0.14, respectively). Individuals who reported aboriginal ethnicity had significantly higher odds of having an SUD than individuals who reported white ethnicity (OR 2.00-1.88).

Model Four added homelife variables. Both marital status and household type were statistically significant in predicting the odds of a SUD. Married individuals and individuals, individuals living alone or with children, and other living arrangements had higher odds of SUD compared to not married and couples living alone.

The fifth model saw the addition of chronic condition and sexuality variables, both of which were statistically significant in predicting SUD. Individuals who reported a chronic condition or that they were homosexual or bisexual had higher odds of SUD.

In model 6, the mental health variables behaved as expected, languishing or moderate mental health and weak community belonging had increased odds ratio of SUD compared to flourishing mental health and strong community belonging.

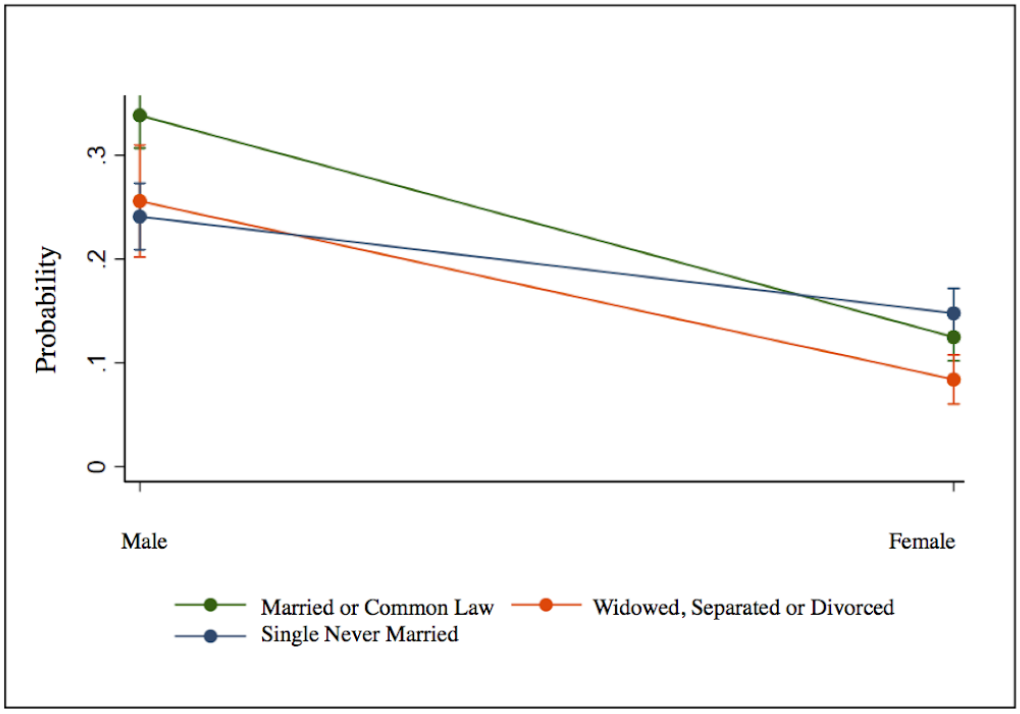
Model 7 and 8 showed the addition of the interaction between sex and marital status, household type and sexuality. The interactions between sex and marital status and sex and household type were statistically significant and included in the final model (model 8).



Graph 5.1: Interaction between Sex and Household Type in the Final Model Describing Substance Use Disorder

Graph 5.1 shows the interaction of Sex and Household Type in the model containing variables describing demographics, individual SES, culture, home life, other, and mental health status. Graph 5.1, as well as table 5.4, show a statistically significant difference in the interaction between male and married or common law and female and single, never married. The statistical significance of this interaction indicates that the effect of being married or common law differs depending on sex. That is, as seen in Graph 5.1, males and females who are married have a similar probability of having a SUD, but males, compared to females, have higher odds of having a SUD if they are married or common law.

Similarly, Graph 5.2 and Table 5.4 indicate the statistical significance of the interaction between sex and household status. Interestingly, the effect of household status is much more pronounced for males than females, as seen by the larger range of probability of having a SUD for males depending on the household type.



Graph 5.2: Interaction between Sex and Marital Status in the Final Model Describing Substance Use Disorder

5.4.3.4 Any Mental or Substance Disorder

As expected, the final model for the Any Mental or Substance Disorder, as seen in Table 5.5, was a combination of the previous three models. All the variables entered in the stepwise edition of the models, with the exception of the mental health variables and interaction between sex and sexuality, were included in the final model as at least one of the variables in the category that the variables represented was statistically significant in models in which the category was included.

Also similarly to the previous models, the variables of age, sex, education, immigration, ethnicity, household type, chronic conditions, and sexuality were robust, in that they were significant in each model regardless of what other variables were included. Older age (45+), female sex, less than secondary school education, immigrants, reporting black, asian, arab, other or multiple ethnicities, couples who live alone, individuals who are widowed, separated or divorced, or single never married, without chronic conditions and who reported being heterosexual had lower odds of having Any Mental or Substance Disorder compared to their reference categories. There was also a significant differnce in the interactions of being sex and marital status and sex and household type.

Table 5.5: Multiple Logistic Regression Models: OR of reporting Any Mental or Substance Disorder by Sociodemographic and Lifestyle Characteristics, Urban Canada 2012

	OR of reporting Any Selected Disorder (95% CI)							
Variable	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
age								
25-44	1	1	1	1	1	1	1	1
15-24	0.88 (0.75 to 1.01)	**0.84 (0.69 to 0.99)**	**0.78 (0.64 to 0.92)**	0.82 (0.63 to 1.02)	0.88 (0.67 to 1.08)	0.91 (0.70 to 1.12)	0.86 (0.66 to 1.07)	0.86 (0.66 to 1.06)
45-64	0.99 (0.85 to 1.13)	0.97 (0.84 to 1.11)	0.91 (0.77 to 1.05)	0.91 (0.75 to 1.06)	**0.85 (0.70 to 1.00)**	0.87 (0.71 to 1.02)	**0.84 (0.69 to 0.99)**	**0.84 (0.69 to 0.98)**
65+	**0.55 (0.46 to 0.64)**	**0.72 (0.58 to 0.87)**	**0.62 (0.49 to 0.76)**	**0.61 (0.46 to 0.77)**	**0.54 (0.40 to 0.67)**	**0.63 (0.46 to 0.79)**	**0.52 (0.39 to 0.66)**	**0.52 (0.39 to 0.66)**
sex								
male	1	1	1	1	1	1	1	1
female	**0.64 (0.57 to 0.72)**	**0.65 (0.57 to 0.73)**	**0.62 (0.54 to 0.70)**	**0.63 (0.55 to 0.71)**	**0.58 (0.50 to 0.65)**	**0.58 (0.51 to 0.66)**	**0.64 (0.51 to 0.78)**	**0.66 (0.51 to 0.80)**
neighbouhood income								
richest	1	1	1	1	1	1	1	1
4	0.98 (0.78 to 1.18)	1.04 (0.82 to 1.26)	1.05 (0.83 to 1.28)	1.03 (0.81 to 1.25)	1.00 (0.77 to 1.22)	1.01 (0.78 to 1.25)	0.99 (0.77 to 1.21)	1.00 (0.77 to 1.22)
3	0.96 (0.79 to 1.14)	1.01 (0.82 to 1.21)	1.06 (0.86 to 1.27)	1.00 (0.81 to 1.20)	0.98 (0.78 to 1.17)	1	0.97 (0.78 to 1.16)	0.97 (0.78 to 1.17)
2	1.11 (0.91 to 1.31)	1.22 (0.99 to 1.45)	**1.29 (1.05 to 1.54)**	1.19 (0.96 to 1.41)	1.16 (0.93 to 1.39)	1.13 (0.90 to 1.37)	1.16 (0.93 to 1.39)	1.17 (0.93 to 1.40)
poorest	1.09 (0.89 to 1.28)	1.23 (0.99 to 1.47)	**1.45 (1.16 to 1.75)**	**1.28 (1.01 to 1.54)**	1.22 (0.96 to 1.47)	1.18 (0.92 to 1.44)	1.21 (0.95 to 1.46)	1.21 (0.96 to 1.47)
individual income								
richest		1	1	1	1	1	1	1
4		0.92 (0.74 to 1.10)	1.03 (0.83 to 1.23)	1.05 (0.84 to 1.26)	1.05 (0.84 to 1.26)	1.02 (0.81 to 1.24)	1.02 (0.82 to 1.23)	1.03 (0.82 to 1.23)
3		0.89 (0.73 to 1.06)	1.11 (0.90 to 1.32)	1.12 (0.91 to 1.33)	1.10 (0.88 to 1.32)	1.02 (0.81 to 1.24)	1.08 (0.86 to 1.29)	1.08 (0.86 to 1.29)
2		**0.66 (0.53 to 0.80)**	0.89 (0.71 to 1.08)	0.87 (0.69 to 1.05)	0.85 (0.67 to 1.03)	**0.80 (0.63 to 0.97)**	0.84 (0.66 to 1.02)	0.84 (0.66 to 1.02)
poorest		**0.76 (0.60 to 0.92)**	1.19 (0.93 to 1.44)	1.12 (0.88 to 1.36)	1.05 (0.82 to 1.28)	0.94 (0.73 to 1.16)	1.03 (0.80 to 1.25)	1.03 (0.80 to 1.25)
education								
post-secondary graduation		1	1	1	1	1	1	1
some post-secondary		**1.55 (1.17 to 1.92)**	1.31 (0.99 to 1.63)	1.31 (0.99 to 1.62)	1.23 (0.92 to 1.54)	1.21 (0.90 to 1.52)	1.24 (0.93 to 1.55)	1.23 (0.93 to 1.54)
secondary school graduation		1.10 (0.93 to 1.28)	0.95 (0.79 to 1.11)	0.96 (0.80 to 1.12)	0.99 (0.82 to 1.16)	0.98 (0.80 to 1.15)	0.99 (0.82 to 1.15)	0.99 (0.82 to 1.15)
less than secondary school graduation		0.94 (0.76 to 1.13)	**0.77 (0.62 to 0.93)**	**0.82 (0.65 to 0.98)**	**0.81 (0.65 to 0.98)**	**0.82 (0.66 to 0.98)**	**0.80 (0.64 to 0.97)**	**0.80 (0.64 to 0.97)**
employment								
employed in last 2 weeks		1	1	1	1	1	1	1
unemployed in last 2 weeks		1.06 (0.90 to 1.21)	1.06 (0.90 to 1.22)	1.05 (0.89 to 1.20)	0.97 (0.82 to 1.12)	0.91 (0.77 to 1.05)	0.99 (0.84 to 1.15)	1.00 (0.84 to 1.15)
immigrant length in Canada								
non-immigrant			1	1	1	1	1	1
0-2 years			**0.33 (0.16 to 0.49)**	**0.33 (0.17 to 0.49)**	**0.40 (0.20 to 0.60)**	**0.42 (0.21 to 0.64)**	**0.39 (0.19 to 0.59)**	**0.40 (0.20 to 0.59)**
3-10 years			**0.40 (0.27 to 0.53)**	**0.43 (0.29 to 0.57)**	**0.48 (0.32 to 0.64)**	**0.50 (0.33 to 0.67)**	**0.48 (0.31 to 0.64)**	**0.47 (0.31 to 0.63)**
11-20 years			**0.48 (0.33 to 0.63)**	**0.51 (0.35 to 0.68)**	**0.52 (0.35 to 0.68)**	**0.52 (0.35 to 0.69)**	**0.52 (0.35 to 0.69)**	**0.52 (0.35 to 0.69)**
21+ years			**0.61 (0.48 to 0.74)**	**0.61 (0.48 to 0.74)**	**0.60 (0.47 to 0.74)**	**0.63 (0.49 to 0.77)**	**0.60 (0.47 to 0.73)**	**0.60 (0.47 to 0.73)**
ethnicity								
white			1	1	1	1	1	1
black			**0.61 (0.37 to 0.86)**	**0.62 (0.36 to 0.88)**	**0.66 (0.38 to 0.93)**	**0.63 (0.34 to 0.92)**	**0.66 (0.38 to 0.93)**	**0.66 (0.38 to 0.93)**
asian			**0.35 (0.26 to 0.45)**	**0.37 (0.27 to 0.47)**	**0.40 (0.29 to 0.52)**	**0.39 (0.28 to 0.50)**	**0.40 (0.29 to 0.52)**	**0.40 (0.29 to 0.52)**
arab			**0.37 (0.12 to 0.63)**	**0.41 (0.13 to 0.69)**	**0.52 (0.18 to 0.85)**	**0.51 (0.17 to 0.85)**	**0.50 (0.17 to 0.83)**	**0.50 (0.17 to 0.83)**
latin american			0.77 (0.42 to 1.12)	0.79 (0.44 to 1.15)	0.74 (0.40 to 1.08)	0.73 (0.40 to 1.06)	0.76 (0.41 to 1.11)	0.76 (0.41 to 1.11)
aborigional			**1.93 (1.34 to 2.51)**	**1.91 (1.31 to 2.51)**	**1.90 (1.26 to 2.54)**	**1.95 (1.27 to 2.64)**	**1.88 (1.25 to 2.50)**	**1.87 (1.25 to 2.50)**

other or multiple	**0.72 (0.45 to 0.99)**	**0.73 (0.46 to 0.99)**	0.73 (0.45 to 1.00)	**0.72 (0.46 to 0.97)**	**0.71 (0.45 to 0.98)**	**0.71 (0.44 to 0.98)**
marital status						
married or common law		1	1	1	1	1
widowed, separated, or divorced		0.88 (0.62 to 1.14)	0.88 (0.61 to 1.14)	0.84 (0.58 to 1.09)	**0.68 (0.40 to 0.97)**	**0.68 (0.40 to 0.97)**
single never married		0.95 (0.71 to 1.20)	0.97 (0.71 to 1.22)	0.89 (0.66 to 1.12)	**0.75 (0.51 to 0.98)**	**0.74 (0.51 to 0.97)**
household type						
couple alone		1	1	1	1	1
individual alone		**1.67 (1.21 to 2.12)**	**1.70 (1.23 to 2.18)**	**1.75 (1.25 to 2.25)**	**2.09 (1.33 to 2.86)**	**2.09 (1.33 to 2.86)**
individual with children		1.25 (0.86 to 1.63)	1.33 (0.90 to 1.75)	1.39 (0.94 to 1.85)	**1.89 (1.08 to 2.70)**	**1.91 (1.09 to 2.73)**
couple with children		0.92 (0.75 to 1.09)	1.01 (0.82 to 1.20)	1.07 (0.86 to 1.28)	1.24 (0.93 to 1.55)	1.25 (0.93 to 1.56)
other		**1.69 (1.15 to 2.23)**	**1.72 (1.15 to 2.29)**	**1.87 (1.22 to 2.51)**	**2.13 (1.19 to 3.07)**	**2.12 (1.19 to 3.06)**
chronic conditions						
no chronic condition			1	1	1	1
chronic condition			**2.27 (1.94 to 2.59)**	**2.12 (1.81 to 2.42)**	**2.29 (1.96 to 2.61)**	**2.28 (1.96 to 2.61)**
sexuality						
heterosexual			1	1	1	1
homosexual or bisexual			**2.68 (1.76 to 3.60)**	**2.40 (1.61 to 3.20)**	**2.03 (1.09 to 2.97)**	**2.69 (1.78 to 3.61)**
mental health status						
flourishing mental health				1		
languishing mental health				**'.35 (3.34 to 11.37)**		
moderate mental health				**2.19 (1.86 to 2.51)**		
sense of community belonging						
strong sense of community belonging				1		
weak sense of community belonging				**1.22 (1.06 to 1.37)**		
interaction of sex and marital status						
male and married or common law					1	
female and widowed, separated, or div					1.71 (0.80 to 2.62)	1.71 (0.80 to 2.61)
female and single never married					**1.79 (1.13 to 2.46)**	**1.84 (1.16 to 2.51)**
interaction of sex and household type						
male and couple alone					1	1
female and individual alone					**0.63 (0.34 to 0.92)**	**0.63 (0.34 to 0.92)**
female and individual with children					**0.48 (0.21 to 0.74)**	**0.47 (0.21 to 0.73)**
female and couple with children					**0.63 (0.42 to 0.84)**	**0.62 (0.42 to 0.83)**
female and other					**0.61 (0.23 to 1.00)**	0.62 (0.23 to 1.01)
interaction of sex and sexuality						
male and heterosexual					1	
female and homosexual or bisexual					1.95 (0.62 to 3.28)	

5.5 Discussion

The regression results served a number of purposes. First, the logistic regressions demonstrated validity by its consistency with prior literature surrounding individual SDOH and mental health disorders. The data also outlined the importance of specificity in both outcome and covariate when considering the impact of SDOH mental health disorders. The difference between the simple logistic and multiple logistic regression results emphasized the necessity of studying results within the environmental context. The results also pointed to the need for increasingly detailed data, continued evaluation and hinted at towards a framework for intervention.

Considering **sex**, studies have shown that females are almost twice as likely to males to experience Major Depressive Disorder, [12,14,39] but equally as likely to experience Bipolar Disorder[40–42], so an odds ratio of 1.31 for MD comparing females to males is well within the expected range. Prior research also demonstrated females having a higher likelihood of experiencing Generalised Anxiety Disorder, [14] but a lower likelihood of experiencing SUD [40,43]; both of which were reflected in the results.

The effect of **immigration status** was also notable in its exact consistency with prior literature. Two theories surrounding the healthy immigrant effect were found in the literature. The first suggests that recent immigrants have the highest degree of health (compared to either non-immigrants or immigrants who lived in Canada for longer duration) and that their health regresses to the national norm over time. [20,44,45] This gradation was observed in both MD and AD. The second theory postulates that there is a U-shaped curve, with higher degrees of mental health disorders at less than 2 years or greater than 20 years compared to the 2-20 year period. [22] This effect was observed in the SUD; immigrants who had lived in Canada for 3-20 years had a lower odds ratio than those who had lived in Canada either 0-2 or 21+ years.

The results of this study also echoed the literature examining the increased odds (OR MD 3.5; AD 4.3; SUD 2.3) of mental health disorders in individuals who report having **chronic conditions.** [11,29,30,46] Chronic conditions consistently had one of the highest OR in the final adjusted models. However, due to the ambiguity of the category "chronic conditions" little can be inferred from these results.

Amongst those who identified as **homosexual or bisexual (**OR of 2.3 for MD and 2.4 AD) the odds were slightly above estimates found in one study, [47] but in line with what other researchers found. [31,33,48] Previous studies had also disagreed with the relationship between sexual minorities and SUD; this study found that persons who identify as bisexual or homosexual were 1.5 times more likely to experience a SUD, which was exactly as found by King et al. [33]

The effect of **marital status** was not consistent across the disorder studied. Marital status was not included in the final model predicting MD, and individuals who were married or common-law had higher odds than non-married in the model predicting SUD. This was not expected based on previous studies that found that marriage was associated with lower rates of depression, anxiety and substance abuse. [49] Bulloch et al [50] also found a modifying effect of gender on the marital status/depression which was not found in this study. A plausible explanation for these discrepancies is that these studies did not include as many covariates in their models; marital status was statistically significant in the simple logistic regression predicting MD. However, this would not explain the unexpected effect of marital status on SUD.

Prior literature also found that lower-**income** was associated with SUD [28,51], but the results from this study indicated mixed results. The neighbourhood income measure, as well as the educational measure, agreed that lower SES was associated with higher odds of SUD. However, there were statistically significantly lower odds of SUD in individuals of lower-income and unemployed individuals than in individuals of higher income and employed individuals.

Explanations for this discrepancy include that the SUD included dependence or abuse of cannabis, alcohol, sedatives, tranquilisers, stimulants, analgesics, club drugs, hallucinogens, and other illegal drugs. It is possible that due to the cost of these drugs,[52] the income individual variable does not accurately portray the lifestyle that is generally conceptualized by the use of adjusted income. That is, the amount of income spent on any of these substances by an individual who has a SUD could cause a large enough discrepancy between the amount of money they report earning and the functional amount of money spent on daily expenses that they would conceptually be living in a different SES than would be expected based on their income. [53] Said a different way, the adjusted income variable is meant to help convey the access an individual has to material resources because of their income. This variable could therefore not be a good indicator of access to resources if a large enough proportion is used on SUD.

An alternative explanation for this discrepancy is that individual income was a self-reported variable in the CCHS, while neighbourhood income was not self-reported collected by the Canadian Census. It is, therefore, possible due to various reasons that the self-reported variable is inaccurate.

Interestingly in the MD and AD the **individual and household income** were also not as robust as expected. However, many of the SDOH could potentially act as mediating variables that would reduce the effect of income. [54]

The multiple logistic models provided information as to the context of the effects. For example, in the simple logistic regression analysis marital status and household type significantly impacted the odds of an individual having a MD, however, when these variables were added into a model that already included measures of demographics, SES and culture the effects were no longer statistically significant, and these variables were excluded from the final model.

The inclusion of variables in the multiple logistic regression model also leads to a clearer understanding of how the variables interact with the mental health disorder outcome variable.

In the simple logistic models, individuals who reported asian or black ethnicities had decreased odds compared to those who reported white ethnicity, while those who reported aboriginal ethnicity had statistically significantly higher odds of having a MD or AD. However, when **ethnicity** was added into the model already containing demographic information and SES, this effect was no longer significant. Similar results have been found in other studies. [55,56] This suggests a different pathway to mental health disorders that could not be elucidated in the simple logistic regression analysis. That is, the effect of aboriginal ethnicity having an increased odds of an MD or AD is not necessarily a product of ethnicity, but rather that individuals in this ethnicity might be more likely to be in the lower SES groups which were robustly correlated to MD and AD. This information could have important policy implications: in efforts to create an increasingly equal society in terms of ethnicity, the focus should be culturally appropriate interventions and policies directed at the SDOH that were found to robustly impact, rather than focusing on the effects of ethnicity on the mental health outcomes. It is also important to note

when discussing ethnicity, confounding variables describing factors such as racism, oppression and colonization that have been irrevocably tied to mental health outcomes particularly in the Indigenous community were not included in the model. [57,58]

The regression results clearly indicated the importance of considering the mental health outcomes individually, and not as a combined category as was seen in the "Any Mental or Substance Disorder" outcome. The SDOH impact mental health outcomes in different ways, in that some SDOH are more pertinent to certain disorders [59,60], and this differentiation is masked when the outcome is combined.

Cultural variables were much more important in predicting the odds of SUD than MD. Almost all of the ethnic variables were insignificant in predicting the odds of MD, whereas all but two categories were statistically significantly different from white ethnicity in predicting the odds of SUD. This echoes previous studies that excluded ethnicity in predicting MDs. [59]

Other SDOH impacted mental health outcomes in opposite ways. Males had greater odds of having an SUD, while females had greater odds of having an MD or AD. Employed and married individuals also had higher odds of having a SUD, while unemployed and widowed, separated or divorced had higher odds of having an AD. Therefore combining mental health disorders in one category is nonsensical, and not accurately represent the interactions of SDOH and mental health outcomes. This is exemplified in the household variables: the odds of having Any Mental or Substance Disorder are highest amongst married couples compared to separated, widowed divorced, or single individuals, but are lowest for couples living alone than any other combination.

When examining the multiple logistic regression models, there are two sets of variables which required additional evaluation and so deserve extra discussion: inclusion of mental health variables in the MD and AD models, and the interaction terms between sex and the homelife variables.

The inclusion of mental health variables was seen in model 6 of the MD and AD regressions. However, the addition also statistically significantly changed the impact of variables that were previously in the model. Further analysis of the "mental health status" and "sense of community belonging" variables suggested that these variables were effect mediators, that is, they acted as an intermediate between the SDOH and the mental health outcomes. As the purpose of this study was to examine the effect between the SDOH and MD or AD, the mental health covariates were excluded from the final model. Interestingly, this effect was not seen when the mental health variables were added to the SUD model. This suggests that there is a different pathway between the SDOH and MD and AD than between the SDOH and SUD, and adds to the argument for evaluating each of these disorders individually.

The impact of gender roles was evaluated by the inclusion of the interaction terms of sex and marital status and sex and household type. There was the limited significant difference between the variables or increase in the goodness of fit of the models due to the addition of these variables. Research suggests that gender roles do impact mental health outcomes, [61] but it is likely that the current study size and specificity were not big enough to elucidate these findings.

There were a number of limitations in the study. The first, and limitation with the largest impact on the results, was the sample size. The CCHS collects self-reported health data annually,

but to date, the mental health component has only been administered twice. Furthermore, the two surveys were different enough that prohibited either the comparison between years or the combination of the data. So the sample size of one year of the CCHS is not large enough to conduct a city-level analysis or to conduct analysis on smaller subsections of mental health disorders. The importance of city-level analysis was shown to be important in the previous manuscript. The make-up of Canadian cities is diverse enough that the relative importance of individual SDOH is not homogenous across the country. City-level analysis is especially important when considering that the aim of these studies is to lead to interventions to reduce inequalities. The implications of combining mental health disorders were previously discussed. However, these reasons can also be applied to combining various mood, AD or SUD into one category. Prior research has suggested that like the combination of MD, AD, and SUD was unhelpful in portraying the effect of SDOH on any of the disorders, that there might be similar discrepancies within the categories of disorders. For example, studies have found sex differences in the prevalence of Major Depressive Disorder, [12,14,39] but not in Bipolar Disorder, [40–42] both of which are included in the MD category.

The second limitation was that the results of the study were based on self-reported data. The outcome variables were concerned with the lifetime prevalence of the disorders, so it is possible that due to recall error, individuals could have incorrectly reported answers. It is also possible that due to the sensitivity of the topics discussed and social desirability that individuals were unwilling to completely disclose their experiences. [62]

A third limitation is due to the intersectoral complex nature of the SDOH. It is impossible to disentangle the determinants from one another or to account for all aspects of the SDOH in one model. This paper focused only on a few variables that describe the structural components of the SDOH. [63] It therefore not only missed aspects of the SDOH outlined by the Government of Canada such as childhood experiences, physical environments, healthy behaviours, access to care, biology and racism, [2] but also could not include other macro and micro factors such as economic policies or health systems. However, due to data availability constraints and plausibility of interpretation of the data, it would be unrealistic to attempt to capture the full extent of the SDOH in one model. This study instead used the data available to make parsimonious and interpretable models, accepting that they do not fully capture the extent of the SDOH.

Finally, the data set was cross-sectional, which means that this paper could only discuss the association between the SDOH, not causation.

In conclusion, this paper highlights the need for increased data and monitoring of the SDOH surrounding mental health outcomes in Canada. These data need to be city-specific, include in-depth descriptions of mental health disorders and be collected at regular intervals. The age variable in these studies suggests a generational shift in the prevalence of mental health. As the lifetime prevalence was highest in the middle and youngest age categories, it can be expected that, unless intervention is effective in reducing the incidence of mental health disorders in younger populations, as these current generations age the overall population prevalence will increase. This indicates a need for continued monitoring of mental health outcomes.

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6. DISCUSSION

This final chapter works to summarize the results of the two manuscripts found in chapters four and five, then to discuss the results in the context of the overall thesis purpose, the framework, and in society. This chapter, and thesis, conclude with overall recommendations and future work.

6.1 Restatement of Purpose

The Social Determinants of Health have been studied for centuries, but their application to mental health has been much more recent. There remains a large gap in knowledge surrounding income-related mental health inequalities in Canada and the relative impact of the social determinants of health on mental health disorders.

The framework proposed by the WHO served as the foundation of this project. The framework attempted to conceptualize the complicated interrelation between structural determinants, intermediary determinants, social cohesion and social capital, and all of these reciprocal relationships with equity in health and well-being. As discussed in Chapter Two, the papers in this manuscript focused on a small portion of this framework, analyzing only factors that related to the socioeconomic position branch of the structural determinants of the social determinants of health inequalities.

The purpose of this thesis was to work within the framework towards filling the gaps in knowledge surrounding SDOH and urban mental health with the ultimate goal of empowering decision-makers to implement upstream strategies to eliminate inequalities. This thesis aimed to do so in two ways: 1) quantify and compare the inequalities in mental health between urban cities across Canada and describe how these inequalities are changing over time and 2) investigate whether or how an evaluation of the determinants of mental health in urban Canada could help inform the most effective measures to counter mental illness in areas of low socioeconomic status by highlighting the factors that have the most significant contribution to mental health. These objectives were presented in two papers.

6.2 Review of Results

The first paper (chapter four) only used income to operationalize inequalities. It provided information about how mental health prevalence and inequality rates differ by geography and over time. While mental health inequalities have previously been studied in Canada, [1–6] there is a lack of studies that examined cities across Canada or examined inequalities in a recent time period. Importantly, chapter four concluded that inequalities are present at every level of geography in Canada, and although they are present at different magnitudes, they are not absent from any city. Additionally, there was no one mental health outcome that consistently had inequalities at greater magnitudes in all cities, rather which outcome had the worst inequality varied by city. This study also found that mental health prevalence and inequality rates for Mood Disorder, Anxiety Disorder and Poor Mental Health are either maintained or worsening over-time. Interestingly the results for Life Stress did not follow the same trends as the other three indicators. This could have been due to society's understanding of stress and not equating moderately to extremely stressful days with poor mental health.

Though the use of only a single measure to represent a large concept could be considered limited and simplistic, the use of the variable income is validated by the framework. The framework shows the socioeconomic position variables feeding into the income variable, which can be extrapolated into meaning that income is the best single variable to represent socioeconomic inequalities. The first paper does, however, entirely skip over inclusion of any of the intermediary determinants of the social determinants of health. Again, in this the framework works to justify this decision. The intermediate determinants are considered the determinants of health, not health inequalities, which was not the purpose of the paper in chapter four. Therefore overall, the framework acts to support the methodological decisions from the first paper, but also points out its simplicity.

The second paper, found in Chapter Five, includes more variables than the first, but is still constrained to the availability of data within the CCHS, and the feasibility of the study. It provided information about how the SDOH, particularly age, sex, SES, culture, home life, chronic conditions, sexuality and mental health status contributed to the odds of having a Mood, Anxiety or Substance Use Disorder. The results of the simple logistic regression found that each of the 15 covariates entered into the models was significant in predicting the odds of mental health disorder. However, when the variables were entered into multiple logistic regression models, not all of the covariates remained significant. The covariates did not affect mental health disorders in the same way. For example, sex had the opposite effect on the odds of Mood or Anxiety Disorders versus Substance Use Disorders, and the cultural variables were more important in predicting the odds of an individual having an SUD than an MD. These results emphasized the importance of considering the SDOH in context and evaluating mental health disorders independently.

Again the fifteen variables that go into describing the determinants of health inequalities are found only within the structural determinants of health, not breaching into the intermediary determinants section. The exclusion of intermediate determinants was partially due to limitations in the data set, but also due to the infeasibility of a project with their inclusion. Already a multiple logistic regression model containing 15 variables could be considered non-parsimonious, so instead, these papers focused on select aspects of the structural determinants and their interaction with equity in health and well-being. This could suggest that this study was incomplete as the excluded “intermediary determinants” section of the framework plays a large role in predicting mental health outcomes. However, the goal of this paper was not to establish causality or even suggest the necessity of a lack of structural determinants of health in developing mental health disorders. Rather the goal was to point to factors that have a large contribution, and in this, the paper succeeded.

Interestingly there are variables within the second paper that do not clearly fit into the framework. Variables such as marital status, chronic conditions, and sexuality are not well captured by the framework. They are not large scale or political enough to be considered in the socioeconomic and political context, but though they could be considered to contribute to socioeconomic position, are not generally considered good measures of it. However, if the model was expanded to contain these variables, they would fit into the same or a parallel section as the socioeconomic position variables in terms of the way that they are affected by more macro variables and in turn influence the intermediate variables.

The framework is also limited in that it describes the presence of a relationship between variables and equity in health and well being, but it does not describe the magnitude or the direction of these relationships. The second paper (chapter five) found that these relationships differ by the mental health outcome studied. For example, the aformentioned sex variable. Sex was significant in predicting MD, AD, and SUD, but how it did so differed. Females were 1.7 times more likely than males to have an AD, but only 1.3 times more likely than males to have an MD, whereas males were over 3 times more likely than females to have a SUD. Similarly, variables such as marital status were not significant in predicting the odds of having a MD, but were significant in predicting the odds of having an AD or SUD, but again, the direction of the effect was opposite in the two disorders.

However different the effect of these covariates on the outcome variable, the framework is still useful in describing the relationship. This is because the framework is not specific enough to describe the nature of the relationship between determinant and outcome, only that a relationship exists. This makes the framework ideal for a project such as this one that aims to describe relatively diverse outcomes, but not ideal to suggest policy change. If the model was going to be adapted for a specific mental health outcome, the specifics such as including "male" or "female" instead of the broader term of "gender" could be incorporated.

Overall, the results provided in the two manuscripts found in chapters four and five did fulfill the purpose of this thesis by progressing the knowledge of the relationship between the SDOH and mental health in Canada. However, though the quantitative goals of the studies were met, the impact of the results is not as substantial as hoped due to limitations in the structure and quantity of data available. As already mentioned, this study only examines one small portion of the framework and the relationship between the variables in that section and the outcome variables that represent equity in health and well-being. Due to data limitations that constrained the variables to not include any policy, political or intermediate determinants, and the nature of the cross sectional design, the holistic nature and causal mechanisms that are indicated in the framework were not able to be fully examined. That is, it is unclear if the determinants increased the odds of the mental health disorder, or the mental health disorder increased the odds of the determinant. When relating social position and health, the theories of Social Causation and Social Selection (discussed in chapter two) offer explanations for both sides. Deciphering between which of these theories is predominant in the specific mental health disorder is important for policy makers to determine which interventions are most effective at what point in an individual's lifespan to keep the individual mentally healthy. The current studies were only able to describe a limited relationship between the social determinants and outcomes, with more variables, or a longitudinal study, a more complete picture of inequalities could be elucidated.

Taken together, the results and limitations of these papers had two implications: there is a need for more mental health research in Canada and mental health research needs to be specific. The descriptive statistics of both manuscripts highlighted the importance of mental health research. Mental health disorders affect over 30% of the urban Canadian population over the age of 15, and the rates of mental health disorders are increasing and the inequalities are not decreasing. Ideally, mental health research should include specifics of disorders, geographies and determinants. The first manuscript was able to provide specific geographies while the second manuscript using a different data set was specific about the mental health disorder. The first

manuscript concluded that there were geographical differences while the second demonstrated mental health disorder and determinant specific differences. All of these details are needed to understand what aspects of the population most affected by mental health disorders in each city. Together these conclusions suggest that the results from this thesis alone cannot inform policy but they can inform where and how more research is needed to inform policy.

6.3 Future Work and Recommendations

Future studies could expand the model to also examine the aspects of the model that were not evaluated in this thesis, including the current policy, values and governance of the geographies as well as the intermediate determinants of material, behavioural, biological and psychological factors. This would require a new or additional data set as these data were not available within the CCHS and Canadian Census, the two datasets used in this thesis. Due to the cross sectional nature of the data, causality could not be determined. Future studies could use a longitudinal study design to give a better indication of causality.

The current national and provincial plans surrounding mental health and addictions point to the need for this additional research.

Saskatchewan's current Mental Health and Addictions Action Plan [7] is centered around 7 goals including access to care, prevention, responding to diversity, and reducing stigma. These goals importantly address some of the indicators that were found to impact the odds of having a mental health disorder (ethnicity, immigration status, sexuality). However, the current plan appears to focus on reactionary measures, rather than preventative and upstream interventions. That is, there is no mention of programs or policies in place to prevent the need for the services discussed in the action plan, such as increasing education, employment, or working to reduce chronic conditions. Additionally, the action plan lumped all forms of mental health and addictions together. One of the main outcomes found in Chapter Five was that the determinants of Mood, Anxiety, and Substance Use Disorders function in very different ways. It would therefore make sense to have specific action plans tailored to each disorder. Future work with an increased dataset would provide the information necessary to implement such a plan.

In 2010 a report called "Stepping It Up: Moving the Focus from Health Care in Canada to a Healthier Canada"[8] was released. This document outlined the province-specific plans already in place to reduce inequalities. However, many provinces were lacking mental health-specific plans. Increased data would provide the information needed to create and implement a plan.

In 2012, The Mental Health Commission of Canada released its plan to improve mental health in Canada, "Changing Directions, Changing Lives: The Mental Health Strategy for Canada". [9] Though not a report about health inequalities, the report outlines "Reduce disparities in risk factors and access to mental health services, and strengthen the response to the needs of diverse communities and Northerners" as one of their six strategies to improve mental health. These goals clearly point to a need for consistent data and a tracking of inequalities.

The benefit of increased research to reduce inequalities and the prevalence of mental health disorders goes beyond those diagnosed with disorders. Inequalities, mental health and the SDOH have large implications on society. Not considering the personal or familial repercussions

of the reality that over 30% of Canadians have a mental health disorder, there are both economic and moral concerns surrounding these topics. Inequalities are also present in and affect other fields.

Health inequalities and mental health, in general, have enormous economic burdens in Canada. PHAC estimated that health inequalities cost Canadians $6.2 billion annually. [10] The exorbitant cost analysis has been supported by other studies. Roos et al[11] found that in an equal society, health care costs could be decreased by 15% and PHAC as well as Lemstra et al found that high healthcare costs are associated with low socioeconomic status. [10,12]

Inequalities are expensive, but so are mental health disorders. The Canadian Substance Use Costs and Harms Working Group estimated that SUD costs $38.4 billion in one year due to loss of productivity, criminal justice and health care expenses. These expenses are mainly due to alcohol and tobacco. [13] Smetanin et al calculated that mental health costs in Canada reach an estimated $48 billion annually, and are expected to exceed $2.5 trillion in the next 30 years. [14]

When discussing their findings concerning health inequalities, the WHO stated that "Disadvantage starts before birth and accumulates throughout life." [15] As explained in Chapter Three, health inequalities become moral concerns when they are inequities: inequalities that are avoidable, unnecessary, unfair, and unjust. [16-19] Asasa[20] took this argument further. She proposed that in order for the reduction in health inequalities to be desirable, health inequalities had to be a moral concern. She then concluded that health inequalities could be a moral concern using the following argument:

> "B. Health equity plays an important role in the general pursuit of justice, and
> B2. Health can be used as an indicator of the entire things to be equalized, or
> B3. Each thing to be equalized has moral significance of its own, and it needs to be examined in its own light
> C. Health inequality is an indicator of general injustice in society" [20]

This argument explicates an important point when considering the morality of mental health inequalities- there needs to be a moral significance to the reduction of each aspect of mental health. This requires an understanding of the mechanisms that lead to health inequalities, that is, are the SDOH causally related to mental health. The cross-sectional methodological design prevented this paper from proving causality. However, barriers to health care for low-income persons, [21] and inequality to access, [22] if leading to poorer health would supply a pathway to mental health disorders that suggests that morality is at stake. In 1987, the Alma Ata Declaration symbolized the world leader's commitment to health for all. [23]

Inequalities are also a concern outside of the health sector. Researchers claim that reducing inequality needs to be a focus to reduce climate problems. [24] In economics, the income gap between the wealthiest and poorest neighbourhoods is widening in all urban centres, increasing the economic disparity found between neighbourhoods in urban Canada. [25,26]

Reducing health inequalities is a complicated process. It is unfeasible, even unethical, to consider redistributing health. A logical alternative would be working towards reducing income inequalities, but adjusting income alone is not the key to reducing health inequalities. [27] A broader approach is needed. This report has already discussed the importance of upstream interventions that work on reducing the risk factors that are caused by the SDOH. Much progress

has already been made in this area. There is generally public acceptance of the SDOH and support for interventions. [28,29] Canada has also implemented a "Health in All Policies" approach, which emphasizes the importance of including health consideration in sectors such as transportation, education, housing and agriculture. [30] However, continued work is needed.

From the results of this study, the recommendations have already been stated: the need for more data, and the need for more consistent tracking. With the increase in information, Canada can form specific and implementable plans to reduce inequalities and improve the health and wellbeing of all Canadians.

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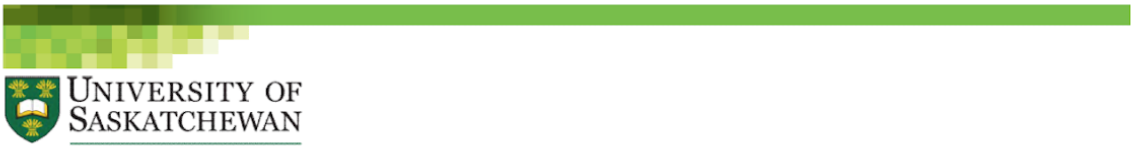
TABLE OF APPENDICES

Appendix A: Ethics Exemption Letter



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Student:	Sharalynn Missiuna, Community Health and Epidemiology
Date:	31-January-2019
RE:	Behavioural Ethics Application ID 784

Thank you for submitting your projected entitled: "Inequalities in Mental Health across Urban Canada". This project meets the requirements for exemption status as per **Article 2.2 of the Tri-Council Policy Statement (TCPS): Ethical Conduct for Research Involving Humans, December 2014**, which states *"Research that relies exclusively on publicly available information does not require REB review when:*

(a) the information is legally accessible to the public and appropriately protected by law; or

(b) the information is publicly accessible and there is no reasonable expectation of privacy."

It should be noted that though your project is exempt of ethics review, your project should be conducted in an ethical manner (i.e. in accordance with the information that you submitted). It should also be noted that any deviation from the original methodology and/or research question should be brought to the attention of the Behavioural Research Ethics Board for further review.

Digitally Approved by Patricia Simonson
Vice-Chair, Behavioural Research Ethics Board
University of Saskatchewan

Appendix B: CCHS Questionnaire Annual- relevant questions

Variable Identification		Answer Option	Code Decision
Variable Name:	poor mental health	1- excellent 2-very good 3- good 4-fair 5-poor	0- very good or excellent mental health 1- good, fair or poor mental health
Variable Code:	gen_02b		
CCHS Label:	Self-perceived mental health		
Question Phrasing:	In general, would you say your mental health is…?		
Variable Name:	life stress	1- not at all 2- not very 3- a bit 4-quite a bit 5- extremely	0- not at all or not very stressful 1- a bit, quite a bit, or extremely stressful
Variable Code:	gen_07		
CCHS Label:	Perceived life stress		
Question Phrasing:	Thinking about the amount of stress in your life, would you say that most days are…?		
Variable Name:	mood disorder	1- yes 2- no	0- does not have a mood disorder 1- has a mood disorder
Variable Code:	ccc_280		
CCHS Label:	Has a mood disorder		
Question Phrasing:	Do you have a mood disorder such as depression, bipolar disorder or mania?		
Variable Name:	anxiety disorder	1- yes 2- no	0- does not have an anxiety disorder 1- has an anxiety disorder
Variable Code:	ccc_290		
CCHS Label:	Has an anxiety disorder		
Question Phrasing:	Do you have an anxiety disorder such as a phobia, obsessive-compulsive disorder, or panic disorder?		
Variable Name:	postal code	n/a	n/a

Variable Code:	geodpc		
CCHS Label:	Postal code		
Question Phrasing:	derived		
Variable Name:	population weight	n/a	n/a
Variable Code:	wts_m		
CCHS Label:	Weights - Master		
Question Phrasing:	n/a		

Appendix C: CCHS Questionnaire Mental Health Component- relevant questions

Variable Identification		Answer Option	Code Decision
Variable Name:	any disorder	1- yes 2- no	0- no 1- yes
Variable Code:	MHPFL		
CCHS Label:	Any selected disorder (mental or substance) - life		
Question Phrasing:	derived		
Variable Name:	mood disorder	1- yes 2- no	0- no 1- yes
Variable Code:	MHPFLM		
CCHS Label:	Any mood disorder - life		
Question Phrasing:	derived		
Variable Name:	general anxiety disorder	1- yes 2- no	0- no 1- yes
Variable Code:	GADDGDS		
CCHS Label:	General anxiety disorder - life		
Question Phrasing:	derived		
Variable Name:	substance use disorder	1- yes 2- no	0- no 1- yes
Variable Code:	MHPFLSA		
CCHS Label:	Any substance use disorder (alcohol/drug) - life		
Question Phrasing:	derived		
Variable Name:	age	continuous	1- 25-44 2- 15-24 3- 45-64 4- 65+

Variable Name:	sex	1- male 2- female	1- male 2- female
Variable Code:	DHH_SEX		
CCHS Label:	sex		
Question Phrasing:	Is respondent male or female?		
Variable Name:	income	continuous	further derived
Variable Code:	INC_3		
CCHS Label:	Total household income- best estimate		
Question Phrasing:	What is your best estimate of the total income received by all household members, from all sources, before taxes and deductions, in the past 12 months?		
Variable Name:	Household size	continuous	further derived
Variable Code:	DHHDHSZ		
CCHS Label:	Household Size		
Question Phrasing:	derived		
Variable Name:	education	1- less than secondary school graduation 2- secondary school graduation 3- some post-secondary school 4- post-secondary graduation	1- post-secondary graduation 2- some post-secondary 3- secondary school graduation 4- less than secondary school graduation
Variable Code:	EDUDR04		
CCHS Label:	Highest level of education- respondent 4 level		
Question Phrasing:	derived		
Variable Name:	employment	1- had a job- at work last week 2- had a job- absent from work last week 3- did not have a job last week 4- permanently unable	1- had a job in the last two weeks 2- did not have a job in the last two weeks
Variable Code:	LDSDWSS		
CCHS Label:	Working status last week		
Question Phrasing:	derived		

		to work	
Variable Name: **Variable Code:** **CCHS Label:** **Question Phrasing:**	immigration status SDCDRES Length of time in Canada since immigration derived	continuous	1- non- immigrant 2- in Canada 0-2 years 3- in Canada 3-10 years 4- in Canada 11-20 years 5- in Canada 21+ years
Variable Name: **Variable Code:** **CCHS Label:** **Question Phrasing:**	ethnicity SDCDCGT Cultural/ racial background derived	1- white 2- black 3- korean 4- filipino 5- japanese 6- chinese 7- south asian 8- southeast asian 9 - arab 10- west asian 11- latino	1- white 2- black 3- asian 4- arab 5- latin american 6- aborigional 7- other or multiple
Variable Name: **Variable Code:** **CCHS Label:** **Question Phrasing:**	marital status DHH_MS Marital Status What is your marital status? Are you married, living common-law, widowed, separated, divorced, or single, never married?	1- married 2- common-law 3- widowed 4- separated 5- divorced 6- single, never married	1- married or common law 2- widowed, separated, or divorced 3- single, never married
Variable Name: **Variable Code:** **CCHS Label:** **Question Phrasing:**	household type DHHDECF Household type derived	1 - unattached individual 2- unattached individual living with others 3- couple alone 4- couple with no children, others 5- couple, children < 25 6- couple, children <25, others 7- couple, all children	1- couple alone 2- individual alone 3- individual with children 4- couple with children 5- other

		>=25 8- couple, all children >=25, others Female lone par., children <25 9- female lone parent, children <25 10- female lone parent, children <25, others 11- female lone parent, all children >=25 12- female lone parent, all children .=25, others 13- male lone parent., children <25 14- male lone parent., children <25, others 15- male lone parent., all children >=25 16- male lone , all children .=25, others 17- other household type	
Variable Name: **Variable Code:** **CCHS Label:** **Question Phrasing:**	chronic condition CCCF1 Has a chronic condition derived	1- yes 2- no	1- no chronic condition 2- chronic condition
Variable Name: **Variable Code:** **CCHS Label:** **Question Phrasing:**	sexuality SDC_7AA Considers self heterosexual/homosexual/ bisexual derived	1- heterosexual 2- homosexual 3- bisexual	0- heterosexual 1- homosexual or bisexual
Variable Name: **Variable Code:**	mental health status PMHDCLA	1- flourishing mental health 2- languishing mental health 3- moderate mental	1- flourishing mental health 2- languishing mental health 3- moderate mental

CCHS Label: **Question Phrasing:**	Positive Mental Health Classification derived	health	health
Variable Name: **Variable Code:** **CCHS Label:** **Question Phrasing:**	sense of community belonging GEN_10 Sense of belonging to local community How would you describe your sense of belonging to your local community? Would you say it is...?	1- very strong 2- somewhat strong 3- somewhat weak 4- very weak	1- strong sense of community belonging 2- weak sense of community belonging
Variable Name: **Variable Code:** **CCHS Label:** **Question Phrasing:**	Census metropolitan area geodvcma Census Metropolitan Area		1- toronto 2- st johns 3- halifax 4- moncton 5- saint john 6- saguenay 7- quebec 8- sherbrooke 9- trois-rivieres 10- montreal 11- ottawa-gatineau 12- kingston 13- petersbourgh 14- oshawa 15- hamilton 16- st. catherines-niagara 17- kitchener 18- brantford 19- guelph 20- london 21- windsor 22- barrie 23- greater sudbury-grand sudbury 24- thunder bay 25- winnipeg 26- regina 27- saskatoon 28- calgary

			29- edmonton 30- kelowna 31- abbotsford 32- vancouver 33- victoria
Variable Name: **Variable Code:** **CCHS Label:** **Question Phrasing:**	Dissemination Area GEODDA11 2011 Census Dissemination Area (DA) derived		
Variable Name: **Variable Code:** **CCHS Label:** **Question Phrasing:**	population weight wts_m Weights - Master n/a	n/a	n/a

Appendix D: Canadian Census of Population

Variable Identification		Answer Option
Variable Name:	population centre type	1- rural areas 2- small population centres 3- medium population centres 4- large urban populations
Variable Code:	pop_cntr_ind (pop_cntr 2011)	
Census Label:	Population centre indicator	
Variable Name:	private dwelling	2 - occupied private N1 9 - occupied private N2
Variable Code:	doctp	
Census Label:	Document type classification	
Variable Name:	dissemination area	
Variable Code:	PRCDDA	
Census Label:	Province, Census Division, Dissemination Area	
Variable Name:	census metropolitan area	0- Territories (outside CAs) 1- St. John's 5 Bay Roberts 10- Grand Falls-Windsor 15- Corner Brook 105- Charlottetown 110- Summerside 205- Halifax 210- Kentville 215- Truro 220- New Glasgow 225- Cape Breton 305- Moncton 310- Saint John 320- Fredericton 328- Bathurst 329- Miramichi 330- Campbellton 335- Edmundston 403- Matane 404- Rimouski 405- Rivière-du-Loup
Variable Code:	cma	
Census Label:	Census metropolitan area or census agglomeration of current residence	

		406- Baie-Comeau 408- Saguenay 410- Alma 411- Dolbeau-Mistassini 412- Sept-Îles 421- Québec 428- Saint-Georges 430- Thetford Mines 433- Sherbrooke 437- Cowansville 440- Victoriaville 442- Trois-Rivières 444- Shawinigan 447- Drummondville 450- Granby 452- Saint-Hyacinthe 454- Sorel-Tracy 456- Joliette 459- Saint-Jean-sur-Richelieu 462- Montréal 465- Salaberry-de-Valleyfield 468- Lachute 480 Val-d'Or 481- Amos 485- Rouyn-Noranda 501- Cornwall 502- Hawkesbury 505- Ottawa - Gatineau 512- Brockville 515- Pembroke 516- Petawawa 521- Kingston 522- Belleville 527- Cobourg 528- Port Hope 529- Peterborough 530- Kawartha Lakes 531- Centre Wellington 532- Oshawa 533- Ingersoll 535- Toronto 537- Hamilton 539- St. Catharines - Niagara 541- Kitchener - Cambridge - Waterloo 543- Brantford 544- Woodstock 546- Tillsonburg 547- Norfolk

		550- Guelph 553- Stratford 555- London 556- Chatham-Kent 557- Leamington 559- Windsor 562- Sarnia 566- Owen Sound 567- Collingwood 568- Barrie 569- Orillia 571- Midland 575- North Bay 580- Greater Sudbury / Grand Sudbury 582- Elliot Lake 584- Temiskaming Shores 586- Timmins 590- Sault Ste. Marie 595- Thunder Bay 598- Kenora 602- Winnipeg 605- Steinbach 607- Portage la Prairie 610- Brandon 640- Thompson 705- Regina 710- Yorkton 715- Moose Jaw 720- Swift Current 725- Saskatoon 735- North Battleford 745- Prince Albert 750- Estevan 805- Medicine Hat 806- Brooks 810- Lethbridge 820- Okotoks 821- High River 825- Calgary 826- Strathmore 828- Canmore 830- Red Deer 831- Sylvan Lake 832- Lacombe 833- Camrose 835- Edmonton 840- Lloydminster

		845- Cold Lake 850- Grande Prairie 860- Wood Buffalo 865- Wetaskiwin 905- Cranbrook 913- Penticton 915- Kelowna 918- Vernon 920- Salmon Arm 925- Kamloops 930- Chilliwack 932- Abbotsford - Mission 933- Vancouver 934- Squamish 935- Victoria 937- Duncan 938- Nanaimo 939- Parksville 940- Port Alberni 943- Courtenay 944- Campbell River 945- Powell River 950 -Williams Lake 952- Quesnel 955- Prince Rupert 965- Terrace 970- Prince George 975- Dawson Creek 977- Fort St. John 990- Whitehorse 995- Yellowknife 996- Strong metropolitan influenced zone 997- Moderate metropolitan influenced zone 998- Weak metropolitan influenced zone 999- No metropolitan influenced zone
Variable Name: **Variable Code:** **Census Label:**	province pr Province or territory of current residence	10- Newfoundland and Labrador 11- Prince Edward Island 12- Nova Scotia 13- New Brunswick 24- Quebec 35- Ontario 46- Manitoba 47- Saskatchewan 48- Alberta 59- British Columbia 60- Yukon

		61- Northwest Territories 62- Nunavut
Variable Name: **Variable Code:** **Census Label:**	primary breadwinner hmain Primary Household maintainer	0- person is not primary maintainer 1- person is primary maintainer
Variable Name: **Variable Code:** **Census Label:**	household total income hhinc Household total income	continuous
Variable Name: **Variable Code:** **Census Label:**	household size NUnits Number of persons in household	continuous
Variable Name: **Variable Code:** **Census Label:**	Census area classification sac Statistical Area Classification of residence	1- CMA 2- CA(tracted) 3- CA(untracted) 4- Stong (MIZ) 5- Moderate(MIZ) 6- Weak (MIZ) 7- Mo influence (MIZ) 8- Territories
Variable Name: **Variable Code:** **Census Label:**	probability weight compw2 Composite Weight	

Appendix E: Stata Code - Manuscript 1

```
//23456789#123456789#123456789#123456789#123456789#123456789#123456789#123456789
//
//Measuring Trends in Mental Health Thesis: CCHS ANALYSIS
//==============================================================================
//Programmer: Sharalynn Missiuna
//Task: Merge harmonize and recode variables from CCHS years 2011-2015
//Date Started: March 13, 2019
//Last Edited: November 18, 2019
//==============================================================================

//Details
//==============================================================================
//Steps
//  0. Setup
//  1. Harmonize CCHS data
//  2. Append Data
//  3. Save versions for PCCF
//  4. Recode CCHS variables
//  XX. Control

//Inputs
//  1. CCHS 2001, 2003, 2005, 2007-2015

//Outputs
//  1. CCHS_2001-15_use.dta

//==============================================================================

* 0. Setup
*-------------------------------------------------------------------------------------------------------------------------------
//name project
local project "CCHS_Harmonize_March2019"

//global settings
set more off, permanently
clear all

//set ado path
adopath + "P:\Proj-18-SSH-SKY-5853_Neudorf_Missiuna_Plante\ADO"

//set directory
global mydata "P:\Proj-18-SSH-SKY-5853_Neudorf_Missiuna_Plante\MHInequalities\Data\Inequalities"

//open log
capture log close main
```

```
local date= subinstr(c(current_date)," ","",.)
log using "$mydata/Log/`project'_`date'.log", name(main) replace

//set graph scheme
set scheme s1color


* 1. Harmonize data from CCHS 2001 to 2014
/* - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
        HARMONIZE_CCHS2001,2003,2005,2007/2014

        FUNCTION
         Several variables in the new CCHS dataset have different names. This script renames them to a
         common name.

        RETURNS
         CCHSMH_`yyyy'_harmonize.dta.dta

        NOTES
         Only harmonizes variables used in analysis
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - */
capture program drop prep_BS
program prep_BS
*-------------------------------------------------------------------------------------------------------------------------------------------

        //generate a unique identification for each individual in bootstrap files

        foreach yyyy of numlist 2001 2003 2005 2007/2014{

                use "$mydata\CCHS_`yyyy'_BS", clear

                tostring personid, replace
                gen uniqueid= sampleid+personid

                save "$mydata\CCHS_`yyyy'_BS_use", replace
        }

                use "$mydata\CCHS_2015_BS", clear

                gen uniqueid= sampleid

                save "$mydata\CCHS_2015_BS_use", replace

end

/*- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - */
capture program drop harmonize_cchs
program harmonize_cchs
```

```
*-------------------------------------------------------------------------------------------------------------------------------
	// open and keep variables of each CCHS year
	foreach yyyy of numlist 2001 2003 2005 2007/2014{
		use "$mydata\CCHS_`yyyy'.dta", clear

		gen year= "`yyyy'"

		destring year, replace

		//some variables missing in 2001 this code adds the variables if they do not appear in the
		//data set

		foreach v in gen_02b ccc_280 ccc_290 {
			capture confirm var `v', exact
			if c(rc) == 111 { // VARIABLE NOT FOUND
				gen `v' = .
			}
		}

		foreach v in genc_02b gene_02b{
			capture confirm var `v', exact
			if c(rc) != 111 { // VARIABLE  FOUND
				drop gen_02b
			}
		}

		foreach v in  cccc_280 ccce_280 {
			capture confirm var `v', exact
			if c(rc) != 111 { // VARIABLE  FOUND
				drop ccc_280
			}
		}

		foreach v in cccc_290 ccce_290 {
			capture confirm var `v', exact
			if c(rc) != 111 { // VARIABLE  FOUND
				drop ccc_290
			}
		}

		//drop all variables that are not needed for analysis
		keep geo*pc gen*_02b gen*_07 ccc*_280 ccc*_290 wts*_m  year sampleid ///
			personid geo*_prv geo*cma*

		//generates same unique ID as was used in the bootstrap files
		tostring personid, replace
		gen uniqueid= sampleid+personid
```

```
		//merges bootstrap files
		merge m:1 uniqueid using "$mydata\CCHS_`yyyy'_BS_use", nogen


		if `yyyy' == 2007 | `yyyy' == 2008{
			drop geodcma1
		}

		// renames variables to common name across the years
		rename  geo*pc		pcode
		rename  gen*_02b		gen_02b
		rename  gen*_07		gen_07
		rename  ccc*_280		ccc_280
		rename  ccc*_290		ccc_290
		rename  geo*prv		prov
		rename   geo*cma*		cma
		rename  wts*_m		weight

		//clean up and save
		compress
		save "$mydata\CCHS_`yyyy'_harmonize.dta", replace

	}

end

* 2. Harmonize data from CCHS 2015
/* - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
	HARMONIZE_CCHS20154

	FUNCTION
	Frustratingly 2015 has a completely different set of variable codes  so it gets its own section to
	recode them all to the same as the previous 14 years.

	RETURNS
	CCHSMH_2015_harmonize.dta

	NOTES
	Only harmonizes variables used in analysis
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - */
capture program drop harmonize_cchs_2015
program harmonize_cchs_2015
*----------------------------------------------------------------------------------------------------------------------------------------------

	use "$mydata\CCHS_2015.dta", clear

	//drop all variables not needed
	keep  sampleid geodvpc gen_015 gen_020 ccc_195 ccc_200 wts_m geo_prv geodvcma
```

```
        //merge files with 2015 bootstrap file
        merge m:1 sampleid using "$mydata\CCHS_2015_BS_use", nogen

        // 2015 also has 500 more bootstrap iterations- drop the extra that are not present in the
        // 2001-2014 versions
        drop bsw501-bsw1000

        rename  geodvpc         pcode
        rename  gen_015         gen_02b
        rename  gen_020         gen_07
        rename  ccc_195         ccc_280
        rename  ccc_200         ccc_290
        rename  wts_m           weight
        rename  geo_prv         prov
        rename   geodvcma       cma

        gen year= 2015

        //clean up and save
        compress

        save "$mydata\CCHS_2015_harmonize.dta", replace

end


* 3. Append data from CCHS 2001 to 2015
/*- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
        APPEND_CCHS2001,2003,2005,2007,2008,2015

        FUNCTION
         Appends CCHS 2001-2015 variables of interest identified above.

        RETURNS
         CCHSMH2001-2015_appended.dta

        NOTES
         Only harmonizes variables used in analysis
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - */
capture program drop append_cchs
program append_cchs
*-------------------------------------------------------------------------------------------------------------------------------------------

        //appends all the files that were created in the previous code sections

        use "$mydata\CCHS_2001_harmonize.dta", clear
```

```
	foreach yyyy of numlist 2003 2005 2007/2015 {
		append using "$mydata\CCHS_`yyyy'_harmonize.dta", force
	}

	save "$mydata\CCHS_2001-15_appended.dta", replace
end


* 4. Generate Prep for PCCF
/*- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
	GENERATE ID

	FUNCTION
	 Saves file versions for PCCF input

	RETURNS
	 CCHSMH2001-2015_appended_wid.dta

	NOTES
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - */
capture program drop prep_pccf
program prep_pccf
*---------------------------------------------------------------------------------------------------------------------------------------------------------------------

	use "$mydata\CCHS_2001-15_appended.dta", clear

	//generate sampleid with only 12 characters
	gen ID =_n
	tostring ID, replace

	replace ID = "00000000000"+ID if strlen(ID)==1
	replace ID = "0000000000"+ID if strlen(ID)==2
	replace ID = "000000000"+ID if strlen(ID)==3
	replace ID = "00000000"+ID if strlen(ID)==4
	replace ID = "0000000"+ID if strlen(ID)==5
	replace ID = "000000"+ID if strlen(ID)==6

	save "$mydata\CCHS_2001-15_appended_id.dta", replace

	//rename postal code variable
	rename pcode PCODE
	label variable PCODE "PCODE"

	//reduce data
	keep ID PCODE

	//save as old version of stata so can be read by SAS program
	erase "P:\Proj-18-SSH-SKY-5853_Neudorf_Missiuna_Plante\PCCF\Data\CCHS_PCCF_U_12.dta"
```

```
	saveold "P:\Proj-18-SSH-SKY-5853_Neudorf_Missiuna_Plante\PCCF\Data\CCHS_PCCF_U_12",
version(12)

	//generate FSE (first three characters of postal code)
	gen FSA =substr(PCODE,1,3)

	//generate LDU (last three characters of postal code)
	gen LDU =substr(PCODE,4,3)

	//reduce data
	keep ID FSA LDU

	//clean up and save
	compress

	//save file as csv version
	export delimited ID FSA LDU using
"P:\Proj-18-SSH-SKY-5853_Neudorf_Missiuna_Plante\PCCF\Data\CCHS_PCCF_U_CSV.csv", replace

end


* 4. Recode MH variables
/* - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
	RECODE_CCHS

	FUNCTION
	 Recodes MH outcome variables into dichotomous form

	RETURNS
	 CCHSMH2001-2015_use.dta

	NOTES
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - */
capture program drop recode_cchs
program recode_cchs
*-------------------------------------------------------------------------------------------------------------------------------

	use "$mydata\CCHS_2001-15_appended_id.dta", clear

	//code national
	gen nat = 1

	//code poor mental health: reported non-excellent or very good self-perceived
	gen bmhealth= .
	replace bmhealth= 1 if inrange(gen_02b,3,5)
	replace bmhealth= 0 if inrange(gen_02b,1,2)
```

```
        //code life perceived stress
        gen lifestress= .
        replace lifestress= 1 if inrange(gen_07,3,5)
        replace lifestress= 0 if inlist(gen_07,1,2)

        //code presence of mood disorder
        gen mood= .
        replace mood= 1 if ccc_280 ==1
        replace mood= 0 if ccc_280 ==2

        //code presence of an anxiety disorder
        gen anxiety= .
        replace anxiety= 1 if ccc_290 ==1
        replace anxiety= 0 if ccc_290 ==2


        keep bmhealth lifestress mood anxiety weight year ID nat cma prov bsw1-bsw500

        save "$mydata\CCHS_2001-15_use.dta", replace

end

* XX. Control
*-------------------------------------------------------------------------------------------------------------------------------

//  1. Harmonize CCHS data
        harmonize data
        prep_BS
        harmonize_cchs
        harmonize_cchs_2015
//  2. Append Data
        append_cchs
//  3. Save versions for PCCF
        prep_pccf
//  4. Recode CCHS variables
        Recode_cchs

exit
```

```
//23456789#123456789#123456789#123456789#123456789#123456789#123456789#123456789
//
//Measuring Trends in Mental Health and Addictions Thesis: Quintile Construction
//==============================================================================
//Programmer: Sharalynn Missiuna
//Task: Open 2001, 2006 & 2011 Censuses and reduce data to DA level, Code Quintiles
//Date Started: March 14, 2019
//Last Edited: November 18, 2019
//==============================================================================
//Details
//==============================================================================
//Steps
//  0. Setup
//  1. Open and harmonize each census
//  2. Append Census
//  3. Calculate Income Quintiles
// XX. Control

//Inputs
//  1. Census 2001, 2006, 2011 (census_2001, census_2006, census_2011)

//Outputs
//  1. census_quintiles.dta

//==============================================================================

* 0. Setup
*-------------------------------------------------------------------------------------------------------------------------

//name project
local project "MHInequalities"
local filename "Census_Merge_Quintiles_March2019"

//global settings
set more off, permanently
clear all

//set ado path
adopath + "P:\Proj-18-SSH-SKY-5853_Neudorf_Missiuna_Plante\ADO"

//set directory
global mydata "P:\Proj-18-SSH-SKY-5853_Neudorf_Missiuna_Plante\MHInequalities\Data\Inequalities"

//open log
capture log close main
local date= subinstr(c(current_date)," ","",.)
log using "P:\Proj-18-SSH-SKY-5853_Neudorf_Missiuna_Plante/Log/`filename'_`date'.log", name(main) replace
```

```
//set graph scheme
set scheme s1color


* 1. Open and harmonize each census
/* - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
	HARMONIZE

	FUNCTION
	 Opens and harmonizes each census

	RETURNS
	Census_2001_harm.dta, census_2006_harm.dta, census_2011_harm.dta

	NOTES
	The 2011 census is more dissimilar to the 2001 and 2006 census than they are to each other
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - */
capture program drop harmonize
program define harmonize
*-----------------------------------------------------------------------------------------------------------------------------------------------

	foreach yyyy of numlist 2001 2006 2011{
		use "$mydata\Census_`yyyy'.dta", clear

		//generate dummy variables to align 2001 and 2006 with 2011
		if `yyyy'==2001|`yyyy'==2006 {
			gen pop_cntr=.
		}

		//rename 2011 census variables to align with 2001 and 2006 code conventions
		if `yyyy'==2011 {
			rename	pop_cntr_ind	pop_cntr
			rename	sac_type	sac
		}

		//keep variables that you need
		keep doctp prcdda pcsd cma pr sac hmain hhinc nunits compw2 pop_cntr

		//rename variables
		rename	doctp		doc_type		//questionnaire type
		rename	prcdda		da			//dissemination area
		rename	cma		cma			//census metro area
		rename	pr		prov			//province
		rename	sac		sac			//census area classification
		rename	hmain		main			//primary breadwinner
		rename	hhinc		hhttinc			//household total income
		rename	nunits		hhsize			//household size
		rename	compw2		weight			//probability weight
```

```
		//recode variables as needed
		if `yyyy'==2001|`yyyy'==2006 {
			gen private= inlist(doc_type,7,8) if !missing(doc_type)		// private dwellings
			gen primary= inlist(main,3) if !missing(main)			// primary breadwinner
			gen urban= inrange(sac,1,8) if !missing(main)			// urban
		}

		//recode variables as needed (2011)
		if `yyyy'==2011 {
			gen private= inlist(doc_type,2,9) if !missing(doc_type)		// private dwellings
			gen primary= inlist(main,1) if !missing(main)			// primary breadwinner
			gen urban= inlist(pop_cntr,2,3,4) if !missing(main)		// urban
			replace urban= 0 if !inlist(sac,1,2,3)				//code non-CMA/CA as
non-urban
		}

		gen hhsize_adj= sqrt(hhsize)						//adjusted household size
		gen year= `yyyy'							//year

		//drop unnecessary observations
		keep if private			//reduce to private dwellings using questionnaire type
		keep if primary			//reduce to household level by selecting for main breadwinner
		keep if urban			//reduce to urban observations

		//collapse to DA level
		collapse (sum) pop=hhsize pop_adj=hhsize_adj total_hhttinc=hhttinc	///
			(first) prov cma csd year urban  [pw=weight], by(da)

		//save use data
		order year prov cma da pop pop_adj total_hhttinc urban
		keep year prov cma da pop pop_adj total_hhttinc urban
		compress
		save "$mydata\census_`yyyy'_harm.dta", replace
	}


end


* 2. Append Census
/* - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
	APPEND_CENSUS

	FUNCTION
	 This function appends harmonized DA-level Census 2001, 2006, 2011
```

```
	RETURNS
	census_appended.dta

	NOTES
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - */
capture program drop append_census
program define append_census
*------------------------------------------------------------------------------------------------------------------------------------------

	//open harmonized and reduced 2001 census
	use "$mydata\Census_2001_harm.dta", clear

	//append harmonized and reduced 2006 and 2011 censuses
	append using "$mydata\census_2006_harm.dta"
	append using "$mydata\census_2011_harm.dta"

	//clean up and save
	compress
	save "$mydata\census_appended.dta", replace

end

* 3. Calculate Quintiles
/* - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
	QUINTILES

	FUNCTION
	Calculates DA level income quintiles for each census at the CMA level

	RETURNS
	census_quintiles.dta

	NOTES
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - */
capture program drop quintiles
program define quintiles
*------------------------------------------------------------------------------------------------------------------------------------------

	use "$mydata\census_appended.dta", clear

	//calculate DA average equivalent incomes
	gen avg_hheqinc_tt= total_hhttinc/pop_adj

	//code quintiles at each level (wealthiest quintile as 5 and the least as 1)

	//drop negative pop values
	sort pop
	drop in 1/3
```

```
        //total tax
        bysort year cma: egen quintile= xtile(avg_hheqinc_tt), nquantiles(5) weight(pop)

        //rename year for merging later
        rename year                census
        rename total_hhttinc       income

        // generate national variable
        gen nat=1

        // keep only variables needed
        keep census quintile da income

        //clean up and save
        compress
        save "$mydata\census_quintiles.dta", replace


end

* XX. Control
*-------------------------------------------------------------------------------------------------------------------------------

//reduce and harmonize each census in turn
//  1. Open and harmonize each census
        harmonize
//  2. Append Census
        append_census
//  3. Calculate Income Quintiles
        quintiles

exit
```

```
//23456789#123456789#123456789#123456789#123456789#123456789#123456789#123456789
//
//Mental Health Inequalities CCHS ANALYSIS
//===============================================================================
//Programmer(s): Sharalynn Missiuna
//Task: Estimate Health Inequalities in Cities for Release
//Date Started: March 18, 2019
//Last Edited: November 18, 2019
//===============================================================================

//Details
//===============================================================================
//Steps
//  0. Setup
//  1. combined harmonized CCHS, PCCF and census
//  2. calculate concentration index
//  3. calculate CMA and National level health inequalities
//  4. create a master spreadsheet for release
//  XX. Control


//Inputs
//  1. CCHS_2001-15_use  (CCHS combined files)
//  2. geo_2001-11_use       (PCCF geographies)
//  3. census_quintiles        (Census income quintiles and urban coding)

//Outputs
//  1. Various tables summarizing health inequalities in cities

//===============================================================================

* 0. Setup
*-------------------------------------------------------------------------------------------------------------------------------


//name project
local projectname "MHInequalities"
local filename "Census_Merge_Quintiles_March2019"

//global settings
set more off, permanently
clear all

//set ado path
adopath + "P:\Proj-18-SSH-SKY-5853_Neudorf_Missiuna_Plante\ADO"

//set directory
global mydata "P:\Proj-18-SSH-SKY-5853_Neudorf_Missiuna_Plante\MHInequalities\Data\Inequalities"
```

```
//open log
capture log close main
local date= subinstr(c(current_date)," ","",.)
log using "P:\Proj-18-SSH-SKY-5853_Neudorf_Missiuna_Plante/Log/`filename'_`date'.log", name(main) replace

//set graph scheme
set scheme s1color


* 1. combined harmonized CCHS, PCCF and census
/* - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
        MAKE_DATA

        FUNCTION
        This function combines the pooled version of the CCHC with the  geographies assigned by
        various versions of the PCCF+ and the quintile codings from the census

        RETURNS
        MHInequalites_use, uw_MHInequalites_use

        NOTES
        Saves two version of basically the same file, one with bootstrap weights, one without
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - */
capture program drop make_data
program define make_data
*-------------------------------------------------------------------------------------------------------------------------------------------

        //open the CCHS
        use
"P:\Proj-18-SSH-SKY-5853_Neudorf_Missiuna_Plante\MHInequalities\Data\Inequalities\CCHS_2001-15_use.dta",
clear

        //merge pccf+ geographies
        merge m:1 ID using
"P:\Proj-18-SSH-SKY-5853_Neudorf_Missiuna_Plante\PCCF\Data\geo_2001-11_use", nogen

        //drop unwanted geography variables
        drop if cma==0

        //create da and cma variables
        gen long da= .
        replace da= da01_pccf01 if inrange(year,2001,2005)
        replace da= da06_pccf06 if inrange(year,2006,2010)
        replace da= da11_pccf11 if inrange(year,2011,2015)

        gen census=.
```

```
        replace census= 2001 if inrange(year,2001,2005)
        replace census= 2006 if inrange(year,2006,2010)
        replace census= 2011 if inrange(year,2011,2015)

        //merge census
        merge m:1 census da using "$mydata\census_quintiles",  nogen keep(1 3)

        // drop if not urban, missing quintile
        drop if missing(quintile)

        keep bmhealth lifestress mood anxiety quintile income da cma prov nat weight census ///
                bsw1-bsw500

        order bmhealth lifestress mood anxiety quintile income da cma prov nat weight census ///
                bsw1-bsw500

        //clean up and save
        compress
        save "$mydata\MHInequalites_use", replace


        drop bsw1-bsw500
        save "$mydata\uw_MHInequalites_use", replace


end

 2. calculate concentration index (estimates)
/* - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
        CONCENTRATION_INDEX_EST

        FUNCTION
         calculates the concentration index for variables

        RETURNS
        CI master.dta

        NOTES
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - */
capture program drop concentration_index_est
program define concentration_index_est
*-------------------------------------------------------------------------------------------------------------------------------------------

        use"$mydata\uw_MHInequalites_use.dta", clear

        //prep data set to perform CI calculations

        foreach x of global outcome{
```

```
		gen n_`x' = 1 if !missing(`x')
	}

	//collapse to neighbourhood level in order to have rates
	collapse (first)nat prov cma census (sum) n_*  bmhealth lifestress mood anxiety income [pw=weight],
by(da)

	//generate rates per DA
	foreach x of global outcome {
		gen p_`x' = `x' / n_`x' *100
	}


	//save file so don't have to open huge file every time
	save "$mydata\temp_CI.dta", replace


	foreach y in 2001 2006 2011{
		use "$mydata\temp_CI.dta", clear
		keep if census== `y'
		save "$mydata\temp_CI_b.dta", replace

		foreach x of global geo{
			use "$mydata\temp_CI_b.dta", clear

			levelsof `x', local(geo_n)

			foreach xi of local geo_n{
				use "$mydata\temp_CI_b.dta", clear
				keep if `x' == `xi'

					foreach v of global outcome{
						preserve
							keep if `v' !=0
							conindex p_`v', rank(income) bounded limits(0 100)

							gen CI = r(CI)
							gen CI_se = r(CIse)
							gen geo = "`x'" + "_" + "`xi'"
							gen outcome = "`v'"

							collapse (first) CI CI_se geo census outcome

							//save individual CI values
							save "$mydata\concentration_index\temp\CI
`x'_`xi'_`y'_`v'.dta", replace
						restore
				}
```

```
                }
            }
        }

        //append files together
        foreach y in 2001 2006 2011{

            use "$mydata\temp_CI.dta", clear

            keep if census == `y'
            levelsof cma, local (cma_n)
            levelsof nat, local (nat_n)
            levelsof prov, local (prov_n)

            use "$mydata\concentration_index\temp\blank.dta", clear
            foreach x of global geo{
                foreach xi of local `x'_n{
                    foreach v of global outcome{
                        append using "$mydata\concentration_index\temp\CI
`x'_`xi'_`y'_`v'.dta"
                    }
                }
            }
            save "$mydata\concentration_index\CI `y'.dta", replace
        }

        use  "$mydata\concentration_index\CI 2001.dta", clear
        append using  "$mydata\concentration_index\CI 2006.dta"
        append using  "$mydata\concentration_index\CI 2011.dta"

        drop if missing(CI)

        //convert to string so can be merged later
        tostring year, replace
        save "$mydata\concentration_index\CI master.dta", replace


End
```

2. calculate concentration index (standard error)

```
/* - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
        CONCENTRATION_INDEX_SE

        FUNCTION
         calculates the bootstrap se values for the concentration index for variables

        RETURNS
        CI master bs
```

```
	NOTES
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - */
capture program drop concentration_index_se
program define concentration_index_se
*------------------------------------------------------------------------------------------------------------------------------------------------

	//set seed for bootstrapping
	set seed 123456

	//select bootstrap sample

	foreach y in 2001 2006 2011{
		use "$mydata\temp_CI.dta", clear
		keep if census== `y'
		save "$mydata\temp_CI_b.dta", replace

		foreach x of global geo{
			use "$mydata\temp_CI_b.dta", clear

			levelsof `x', local(geo_n)

			foreach xi of local geo_n{
				use "$mydata\temp_CI_b.dta", clear

				keep if `x' == `xi'

				save "$mydata\temp_CI_c.dta", replace

				foreach v of global outcome{
					use "$mydata\temp_CI_c.dta", clear
					keep if `v' !=0

					foreach i of numlist 1/500{
						preserve

							bsample, strata(cma)

							conindex p_`v', rank(income) bounded limits(0 100)
							gen CI = r(CI)

							gen geo = "`x'" + "_" + "`xi'"
							gen outcome = "`v'"

							collapse (first) CI geo census outcome

							//save individual CI values
```

```
                                                    save "$mydata\concentration_index\bstrap\CI
`x'_`xi'_`y'_`v'_bs`i'.dta", replace
                                                restore
                                        }
                                }
                        }
                }
        }



        //collapse bootstrap estimates

        foreach y in 2001 2006 2011{

                foreach x of global geo{
                        use "$mydata\temp_CI.dta", clear
                        keep if census== `y'
                        levelsof `x', local(geo_n)

                        foreach xi of local geo_n{

                                foreach v of global outcome{

                                        use "$mydata\concentration_index\bstrap\blank.dta",clear
                                        foreach i of numlist 1/500 {

                                                append using "$mydata\concentration_index\bstrap\CI
`x'_`xi'_`y'_`v'_bs`i'.dta",

                                        }

                                        drop if missing(CI)

                                        collapse (sd) CI (first) geo census outcome
                                        save "$mydata\concentration_index\se\CI `x'_`xi'_`y'_`v'.dta",replace


                                }
                        }
                }
        }

        //append bootstrap estimates


        use "$mydata\temp_CI.dta", clear
```

```
preserve
keep if census == 2001
foreach x of global geo{
	levelsof `x', local(`x'_2001)
}
restore

preserve
keep if census == 2006
foreach x of global geo{
	levelsof `x', local(`x'_2006)
}
restore


preserve
keep if census == 2011
foreach x of global geo{
	levelsof `x', local(`x'_2011)
}
restore

use "$mydata\concentration_index\bstrap\blank.dta",clear

foreach y in 2001 2006 2011{

	foreach x of global geo{

		foreach xi of local `x'_`y'{

			foreach v of global outcome{

				append using "$mydata\concentration_index\se\CI `x'_`xi'_`y'_`v'.dta",


			}
		}
	}
}

rename CI_se bs_se
save  "$mydata\concentration_index\se\se_master.dta",replace

//merge with other CI file

use  "$mydata\concentration_index\CI master.dta", clear
merge 1:1 geo census outcome using "$mydata\concentration_index\se\se_master.dta", nogen
```

```
	drop CI_se
	rename bs_se CI_se

	save "$mydata\concentration_index\CI master bs.dta", replace

end
```

3. calculate CMA and National level health inequalities (unweighted)

```
/* - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
	INEQUALITIES_CALC_U

	FUNCTION
	 Calculates unweighed estimates for support

	RETURNS
	unweighted counts master.dta

	NOTES
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - */
capture program drop inequalities_calc_u
program define inequalities_calc_u
*------------------------------------------------------------------------------------------------------------------------------------------------------------

	use"$mydata\uw_MHInequalites_use", clear

	foreach x of global outcome{
		gen n_`x' =.
		replace n_`x'=1 if !missing(`x')
	}


	foreach x of global geo{
		preserve
			collapse (sum) *bmhealth *lifestress *mood *anxiety, by(`x' census quintile)

			save "$mydata\quintile\unweighted\unweighted counts by `x'", replace
		restore
	}

	use "$mydata\quintile\unweighted\unweighted counts by nat", clear
	append using "$mydata\quintile\unweighted\unweighted counts by prov"
	append using "$mydata\quintile\unweighted\unweighted counts by cma"

	order nat prov cma
	gen geo= ""
	replace geo = "nat" if !missing(nat)
	replace geo = "prov" if !missing(prov)
```

```
replace geo = "cma" if !missing(cma)

gen geolevel =.
replace geolevel = nat if geo == "nat"
replace geolevel = prov if geo == "prov"
replace geolevel = cma if geo == "cma"

tostring geolevel, replace
gen geoname = geo + "_" + geolevel


//save overall counts (not separated by quintile)
preserve
        collapse (sum) *bmhealth *lifestress *mood *anxiety, by(geo census)
        save "$mydata\quintile\unweighted\unweighted counts collapsed", replace
restore

keep  bmhealth n_bmhealth lifestress n_lifestress mood n_mood anxiety n_anxiety census geoname
quintile

//reshape long to wide
reshape wide bmhealth n_bmhealth lifestress n_lifestress mood n_mood anxiety n_anxiety, i(census
geoname) j(quintile)

save "$mydata\quintile\unweighted\unweighted counts master", replace

end
```

3. calculate CMA and National level health inequalities (weighted)

```
/* - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
        INEQUALITIES_CALC_W

        FUNCTION
         Calculates weighed estimates for release

        RETURNS
        Weighted estimates for each year, level of geography, indicator, quintile (rate_`v'_`n'_`y'_`z'_`w)

        NOTES
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - */
capture program drop inequalities_calc_w
program define inequalities_calc_w
*-------------------------------------------------------------------------------------------------------------------------------------------------

                //open first dataset
                use"$mydata\MHInequalites_use", clear

                //generate duplicates for overall rate
```

```
expand 2, gen(duplicate)
replace quintile = 6 if duplicate ==1
drop duplicate

svyset [pweight=weight], bsrweight(bsw1- bsw500) vce(bootstrap) dof(500) mse

foreach v in 2001 2006 2011{
	preserve
		//census
		keep if census==`v'
		save "$mydata\quintile\weighted\temp_a", replace

		//outcome
		foreach n of global outcome{
			use "$mydata\quintile\weighted\temp_a", clear		//drop census
			gen n_`n' =.
			replace n_`n'=1 if !missing(`n')
			keep if !missing(n_`n')

			save "$mydata\quintile\weighted\temp_b", replace //drop census
outcome

			//quintile
			foreach w in 1 2 3 4 5 6{
				use "$mydata\quintile\weighted\temp_b", clear
				keep if quintile == `w'
				save "$mydata\quintile\weighted\temp_c", replace	//drop
census outcome quintile

				//geography
				foreach y of global geo{
					use "$mydata\quintile\weighted\temp_c", clear
					levelsof `y', local(levels)

					foreach z of local levels{
						use "$mydata\quintile\weighted\temp_c",
clear

						keep if `y'==`z'	//drop census outcome
quintile geo

						//generate denominator variables
						gen d_`w'_w =.
						replace d_`w'_w=1 if !missing(`n')

						//rename outcome to numerator variable
						rename `n' n_`w'_w
```

```
                                                        //determine weight using bootstrapping
method
                                                        svy: ratio (rate: n_`w'_w/d_`w'_w)


                                                        matrix ratio = r(table)

                                                        //extracts information from table
                                                        gen rate_`w'_w = ratio[1,1]
                                                        gen se_`w'     = ratio[2,1]

                                                        //collapse information to one line
                                                        collapse (sum) n_`w'_w d_`w'_w (first)
quintile census rate_`w' se_`w'  [pw=weight]


                                                        //generate rounded values
                                                        gen n_`w'_r= round(n_`w'_w,50)
                                                        gen d_`w'_r= round(d_`w'_w,50)
                                                        gen rate_`w'_r =n_`w'_r /d_`w'_r

                                                        //generate identifying variables
                                                        gen geo ="`y'" + "_" + "`z'"
                                                        gen outcome= "`n'"

                                                        //save to merge back in later
                                                        save
"$mydata\quintile\weighted\rate_`v'_`n'_`y'_`z'_`w'", replace

                                                                }
                                                            }
                                                        }
                                                    }
                                restore
                        }

end
```

3. calculate CMA and National level health inequalities (merge)

```
/* - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
        INEQUALITIES_MERGE

        FUNCTION
        Merges weighted inequality estimates

        RETURNS
        master.dta, support_master.dta
```

```
	NOTES
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - */
capture program drop inequalities_merge
program define inequalities_merge
*------------------------------------------------------------------------------------------------------------------------------------------------------

	//generate local values
	use "$mydata\MHInequalites_use", clear
	foreach v in 2001 2006 2011{
		preserve
			keep if census == `v'
			levelsof nat, local(levels_nat_`v')
			levelsof prov, local(levels_prov_`v')
			levelsof cma, local(levels_cma_`v')
		restore
	}

	foreach y of global geo{
		use "$mydata\quintile\blank", clear
		foreach v in 2001 2006 2011{
			foreach z of local levels_`y'_`v'{
				foreach x of global outcome{
					use "$mydata\quintile\weighted\rate_`v'_`x'_`y'_`z'_1", clear
					foreach w in 2 3 4 5 6{
						merge 1:1 geo outcome census using
"$mydata\quintile\weighted\rate_`v'_`x'_`y'_`z'_`w'",nogen
					}
					save "$mydata\quintile\weighted\rate_`v'_`x'_`y'_`z'", replace
				}
			}
		}
	}

	use "$mydata\quintile\blank", clear
	foreach y of global geo{
		foreach v in 2001 2006 2011{
			foreach z of local levels_`y'_`v'{
				foreach x of global outcome{
					append using "$mydata\quintile\weighted\rate_`v'_`x'_`y'_`z'",
				}
			}
		}
	}


	drop if missing(geo)
	save "$mydata\quintile\master_w", replace
```

```
//append to a master file

//create unweighted master
use "$mydata\quintile\unweighted\unweighted counts master", clear


foreach x of global outcome {
	preserve
		keep census geoname `x'* n_`x'*
		gen outcome = "`x'"
		rename `x'* n_*_u
		rename n_`x'* d_*_u
		save "$mydata\quintile\unweighted\unweighted counts `x'", replace
	restore
}


use "$mydata\quintile\unweighted\unweighted counts bmhealth", clear
append using "$mydata\quintile\unweighted\unweighted counts lifestress",
append using "$mydata\quintile\unweighted\unweighted counts mood",
append using "$mydata\quintile\unweighted\unweighted counts anxiety",

rename geoname geo
save "$mydata\quintile\master_u", replace


//merge together
use "$mydata\quintile\master_u", clear
merge 1:1 geo outcome census using "$mydata\quintile\master_w", nogen

//merge with CI
merge 1:1 geo outcome census using "$mydata\concentration_index\CI master bs.dta", nogen


//generate geo type variable
gen geo_type =substr(geo,1,4)
replace geo_type= "nat" if geo_type=="nat_"
replace geo_type= "cma" if geo_type=="cma_"


save "$mydata\quintile\master", replace

use "$mydata\quintile\master", clear
//save results file
preserve

drop n_*_u d_*_u  n_*_w d_*_w rate_*_w quintile
order geo_type geo census outcome n_1_r d_1_r rate_1_r se_1 n_2_r                ///
```

```
		d_2_r rate_2_r se_2 n_3_r d_3_r rate_3_r se_3 n_4_r d_4_r rate_4_r ///
		se_4 n_5_r d_5_r rate_5_r se_5 n_6_r d_6_r rate_6_r se_6

	save "$mydata\quintile\results_master", replace
	restore

	//save support file

	drop  quintile  n_*_r d_*_r rate_*_w se_* n_*_r rate* CI CI_se
	order geo_type geo census outcome

	save "$mydata\quintile\support_master", replace

end
```

4. create a master spreadsheet for release

```
/* - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
	CREATE_EXPORT_FILES

	FUNCTION
	Uses master files to create excel files for release

	RETURNS

	NOTES
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - */
capture program drop create_export_files
program define create_export_files
*------------------------------------------------------------------------------------------------------------------------------------------------

	//results

	foreach y of global geo{

		use "$mydata\quintile\results_master", clear

		keep if geo_type=="`y'"
		keep geo_type geo census outcome *se*

			foreach z of global outcome{
			preserve
				drop if outcome != "`z'"
				save "$mydata\quintile\release\release_results_`y'_`z'", replace
				export excel using "$mydata\quintile\release\release_results_`y'.xls",
///
							firstrow(variables )sheet("`z'",replace)
			restore
```

```
		}

}

//support

foreach y of global geo{

	use "$mydata\quintile\support_master", clear

	keep if geo_type=="`y'"


		foreach z of global outcome{
		preserve
			drop if outcome != "`z'"
			save "$mydata\quintile\release\release_support_`y'_`z'", replace
			export excel using "$mydata\quintile\release\release_support_`y'.xls",   ///
				firstrow(variables )sheet("`z'",replace)
		restore
		}

}

//unweighted counts

foreach y of global geo{
	use "$mydata\quintile\support_master", clear
	keep if geo_type=="`y'"

	foreach z of global outcome{

		save  "$mydata\quintile\release\temp", replace

		drop if outcome != "`z'"

		preserve
			collapse (sum) n_*_u d_*_u , by(census outcome)

			gen geo_t=	"`y'"

			gen total_n = n_1_u + n_2_u + n_3_u + n_4_u + n_5_u
			gen total_d = d_1_u + d_2_u + d_3_u + d_4_u + d_5_u

			save "$mydata\quintile\release\release_counts_`y'_`z'",replace

		restore
```

```
//                                      export excel using "$mydata\quintile\release\release_counts_`y'.xls", ///
//                                                                              firstrow(variables )sheet("`z'",replace)

                                use  "$mydata\quintile\release\temp", clear
                        }
                }

                use "$mydata\quintile\release\blank", clear

                foreach z of global outcome{
                        foreach y of global geo{
                        append using "$mydata\quintile\release\release_counts_`y'_`z'",
                        }
                }

                order geo_t census outcome total_n total_n
                keep geo_t census outcome total_n total_n

                foreach z of global outcome {
                        preserve
                                keep if outcome == "`z'"
                                export excel using "$mydata\quintile\release\release_counts.xls", ///
                                                                              firstrow(variables)sheet("`z'",replace)
                        restore
                }
end


* XX. Control
*-------------------------------------------------------------------------------------------------------------------------------

//list of globals
        global outcome bmhealth lifestress mood anxiety
        global geo nat prov cma

//1. combined harmonized CCHS, PCCF and census
        make_data
//2. calculate concentration index
        concentration_index_est
        concentration_index_se
//3. calculate CMA and National level health inequalities
        inequalities_calc_u
        inequalities_calc_w
        inequalities_merge
//4. create a master spreadsheet for release
        create_export_files

Exit
```

```
//23456789#123456789#123456789#123456789#123456789#123456789#123456789#123456789
//
//Measuring Trends in Mental Health Thesis: CCHS ANALYSIS
//===============================================================================
//Programmer(s): Sharalynn Missiuna
//Task: Open Raw Data and convert to readable tables
//Date Started: October 15th, 2019
//Last Edited: November 16th, 2019
//===============================================================================

//Details
//===============================================================================
//Steps
//  0. Setup
//  1. Create Geographies based on Census data
//  2. Open and reformat data
//  3. Finalize estimates
//  4. Generate comparisons between geographies and over time
//  5. Create data for tables
//  6. Create data for graphs
//  XX. Control

//Inputs
//  1. release_results_nat_REL                                    //national results
//  2. release_results_prov_REL                                   //provincial results
//   3. release_results_cma_REL                                   //city results

//Outputs
//  1. Various tables summarizing health inequalities in cities

//===============================================================================

/* - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -

        TO DO

        NOTES

 - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - */
* 0. Setup
*-------------------------------------------------------------------------------------------------------------------------------

//global settings
        set more off, permanently
        clear all

//set directory
        cd "/Users/sharalynnmissiuna/Desktop/Thesis/Analysis/"
```

```
//name file
		local filename "Inequalities Tables - Oct 2019"

//open log

		capture log close main
		local date= subinstr(c(current_date)," ","",.)
		log using "./Log/`filename'_`date'.log", name(main) replace

//set seed for analysis
		set seed 123456

//set graph scheme
		set scheme s1color


* 1. Create Census Geographies names
/* - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
		MAKE_GEONAMES

		FUNCTION
		Makes file with geography names based on the census file

		RETURNS
		prov names.dta
		cma names.dta

		NOTES
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - */
capture program drop make_geonames
program define make_geonames
*---------------------------------------------------------------------------------------------------------------------------------------

		//Open 2011 Census Geographies file
		import delimited "./Data/CensusGeo_2011.csv", clear

		//Assign name to variables in Census Geographies
		rename	v12	prov
		rename	v13	provname
		rename	v36	cma
		rename	v37	cmaname

		//keep the variables that I need
		keep prov provname cma cmaname

		//drop territories
		drop if prov > 59
```

```
	drop if inlist(cma,996,997,998,999)

	//fix errant cma names
	replace cmaname= "Ottawa-Gatineau"                                              ///
		if cmaname== "Ottawa - Gatineau (partie du Qu    bec / Quebec part)"
	replace cmaname= "Ottawa-Gatineau"                                              ///
		if cmaname== "Ottawa - Gatineau (Ontario part / partie de l'Ontario)"
	replace cmaname= "Montreal"                                                     ///
		if cmaname== "Montr    al"
	replace cmaname= "Quebec"                                                       ///
		if cmaname== "Qu    bec"
	replace cmaname= "St. Johns"                                                    ///
		if cmaname== "St. John's"

	//replace prov names with just english version
	replace provname = "Newfoundland and Labrador"                                  ///
		if provname =="Newfoundland and Labrador / Terre-Neuve-et-Labrador"
	replace provname = "Prince Edward Island"                                       ///
		if provname =="Prince Edward Island / ële-du-Prince-    douard"
	replace provname = "Nova Scotia"                                                ///
		if provname =="Nova Scotia / Nouvelle-    cosse"
	replace provname ="New Brunswick"                                               ///
		if provname =="New Brunswick / Nouveau-Brunswick"
	replace provname = "Quebec"                                                     ///
		if provname =="Quebec / Qu    bec"
	replace provname = "British Columbia"                                           ///
		if provname =="British Columbia / Colombie-Britannique"

	preserve
		//collapse to prov level and save
		collapse (first) provname, by(prov)
		compress
		save "./Data/prov names.dta", replace
	restore

	//collapse to CMA level and save
	collapse (first) cmaname, by(cma)
	compress
	save "./Data/cma names.dta", replace
End

* 2. Open and harmonize dataset
/* - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
	MAKE_GEONAMES

	FUNCTION
	Opens and harmonizes data released from the RDC
```

```
	RETURNS
	inequalities use.dta

	NOTES
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - */
capture program drop open_data
program define open_data
*------------------------------------------------------------------------------------------------------------------------------------------------

	//open files
	foreach y of global geo{
		foreach x in lifestress anxiety mood{
			import excel using "./Data/release_results_`y'_", sheet("`x'") firstrow clear
			save "./Data/raw data `x' `y'.dta", replace
		}
	}

	use "./Data/blank.dta", clear
	drop a

	foreach y of global geo{
		foreach x in lifestress anxiety mood{
			append using "./Data/raw data `x' `y'.dta"
		}
	}

	//sort out geo mess:

	//generate geogrpahical level variable
	gen geolevel = substr(geo, 1,4)
	replace geolevel = "nat" if geolevel == "nat_"
	replace geolevel = "cma" if geolevel == "cma_"

	//generate individual geo level indicators
	gen nat = ""
	replace nat = substr(geo, 5,.) if geolevel=="nat"
	destring nat, replace

	gen prov = ""
	replace prov = substr(geo, 6,.) if geolevel=="prov"
	destring prov, replace

	gen cma = ""
	replace cma = substr(geo, 5,.) if geolevel=="cma"
	destring cma, replace

	//fill in geo names using Census Geo data
	merge m:1 cma using "./Data/cma names.dta", keep(1 3) nogen
```

```
	replace cmaname= "Canada" if cma == 0
	merge m:1 prov using "./Data/prov names.dta", keep(1 3) nogen
	gen natname = "Canada" if nat == 1

	drop geo
	//label geography names
	gen geo= .
	gen geoname =""

	foreach x of global geo{
		replace geoname = `x'name if !missing(`x')
		replace geo = `x' if !missing(`x')
	}
	replace geo = 999 if natname == "Canada"

	labmask geo, values(geoname)

	rename *_r *

	//generate overall n d rate and se
	foreach x in n d rate {
		gen `x'_all = `x'_1 + `x'_2 + `x'_3 + `x'_4 + `x'_5
	}

	replace rate_all =rate_all/5

	rename se_6 se_rate_all
	drop nat*

	//clean up data
	keep outcome census n* d* rate* se* geolevel geo CI*
	order se*, last
	order census outcome geolevel geo *1 *2 *3 *4 *5  *all
	compress

	save "./Data/inequalities use.dta", replace
end



* 3. Finalizes Estimates
/* - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
	MAKE_DATA

	FUNCTION
	Finalizes inequality statistics

	RETURNS
```

```
	inequalities master.dta

	NOTES
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - */
capture program drop make_data
program define make_data
*------------------------------------------------------------------------------------------------------------------------------------------

	//append CIHI and CCHS data sets
	use   "./Data/inequalities use.dta", clear

	//convert tabulations to percentages
	foreach x of varlist rate*{
		replace `x' = `x' * 100
	}

	foreach x of varlist se*{
		replace `x' = `x' * 100
	}

	// round rate to nearest integer
	foreach x of varlist rate* {
		replace `x'= round(`x',0.1)
	}

	//generate rr rd and se statistics
	gen rd= rate_1 - rate_5

	gen rr= .
	replace rr= round(rate_1/rate_5, 0.01)

	//generate standard errors
	gen se_rd=sqrt(se_1^2 + se_5^2)
	gen se_rr=sqrt(rr^2 * (se_1/rate_1)^2 + (se_5/rate_5)^2)

	//generate ln rr for comparisons
	gen lnrr= ln(rr)
	gen se_lnrr= sqrt(((se_1/rate_1)^2 + (se_5/rate_5)^2))

	//generate names to use for graph labels
	gen str ind_name =""
	replace ind_name = "Mood Disorder"         if outcome == "mood"
	replace ind_name = "Anxiety Disorder"      if outcome == "anxiety"
	replace ind_name = "Stress"                if outcome == "lifestress"
	replace ind_name = "Poor Mental Health"    if outcome == "bmhealth"

	//generate confidence intervals for rates, rr and rd
	foreach x in rr rd rate_all {
```

```
		gen ci_ul_`x' = `x' + 1.96* se_`x'
		gen ci_ll_`x' = `x' - 1.96* se_`x'
	}

	rename se_rate_all se_all
	//save version to use for graphs
	save "./Data/Inequalities Master.dta", replace

end


* 4. Generate Comparison
/* - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
	GEN_COMPARISON

	FUNCTION
	Compares rates and inequalities previously calculated between geographies
	and over time

	RETURNS
	comparison rate.dta
	comparison rr.dta
	comparison rd.dta
	comparison ci.dta
	comparison lnrr.dta

	NOTES
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - */
capture program drop gen_comparison
program define gen_comparison
*-------------------------------------------------------------------------------------------------------------------------------------------

	//Comparison between cities and Canada overall in census year 2011
	foreach z in rate rr rd ci lnrr{

		//open dataset
		use "./Data/Inequalities Master.dta", clear

		keep outcome census *all  geolevel geo  *rr *rd CI*

		rename CI*	ci*
		rename rate_all rate
		rename se_all   se_rate
		rename se_*	*_se

		//reduce to only needed variables
		keep if census == 2011
```

```
keep geo outcome `z' `z'_se

//reshape dataset to wide from long
reshape wide `z' `z'_se, i(geo) j(outcome)string

//rename stub variables from reshape to workable names
rename `z'* *
rename _se* se*

//save canada overall data to merge back in later
preserve
	keep if geo== 999
	save "./Data/Canada data temp.dta", replace
restore

//sort cities west to east in order
sort_westeast
drop westeast geoname

//create canada overall variables to compare with other cities
foreach x of global varlist {
	gen `x'_can = `x'[1]
	gen `x'_se_can= se`x'[1]
}

//drop Canada overall data
drop in 1
save "./Data/temp.dta", replace

// calculate difference between cites and overall, and significance
foreach x of global varlist {

	//calculate difference and se
	gen city_can_dif= `x'_can - `x'
	gen city_can_dif_se= sqrt(`x'_se_can^2 + `x'_se^2)

	//calculate p-values
	gen p_value=  2*normal(-abs(city_can_dif/city_can_dif_se))

	//indicate statistical significance
	gen `x'_sig= ""
	replace `x'_sig= "*" if p_value < 0.05
	replace `x'_sig= "**" if p_value < 0.01
	replace `x'_sig= "***" if p_value < 0.001

	//drop unneeded variables
	drop city_can_dif_se city_can_dif p_value
```

```
		}

		//add back in Canada data
		append using "./Data/Canada data temp.dta"

		//resort data
		sort_westeast
		drop westeast geoname

		//drop unneeded variables
		drop se* *_can

		//round estimates
		if "`z'"== "rr"{
			foreach x of global varlist{
				gen `x'_r = string(round(`x', 0.01))
				drop `x'
				rename `x'_r `x'
			}
		}

		else if "`z'"== "rd" || "`z'"== "rate"{
			foreach x of global varlist{
				gen `x'_r= string(round(`x',0.1))
				drop `x'
				rename `x'_r `x'
			}
		}

		order *_sig, last
		order  geo bmhealth* lifestress* mood* anxiety*

		save	"./Data/Comparison `z'",	replace
	}
end

* 5. Tables
/* - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
	DATA_TABLE1
	DATA_TABLE2
	DATA_TABLE3
	DATA_TABLE4

	FUNCTION
	Makes excel tables for presentation in manuscript

	RETURNS
	Theis Tables:
```

```
		Table 1
		Table 2
		Table 3
		Table 4

	NOTES
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - */
capture program drop  data_table1
program define  data_table1
*-------------------------------------------------------------------------------------------------------------------------------------------

	//descriptives 2011

	use "./Data/Inequalities Master.dta", clear

	keep census outcome geo  se_all
	keep if census == 2011
	rename se_all se
	drop census

	reshape wide  se, i(geo) j(outcome)string

	merge 1:1 geo  using  "./Data/Thesis Table 1 rate", nogen

	order geo bmhealth sebmhealth ///
		bmhealth_sig lifestress selifestress lifestress_sig  mood semood ///
		mood_sig  anxiety seanxiety anxiety_sig

	sort_westeast
	drop westeast geoname

	order geo

	export excel using "./Data/Thesis Tables.xls",			///
		sheetreplace sheet("Table 1") firstrow(varlabels)

end

*- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
capture program drop  data_table2
program define  data_table2
*-------------------------------------------------------------------------------------------------------------------------------------------

	//between cities

	use "./Data/Comparison CI", clear
	foreach x of global varlist{
		rename `x' `x'_CI
```

```
		rename `x'_sig `x'_CI_s
	}
	merge 1:1 geo using "./Data/Comparison RR", nogen
	foreach x of global varlist{
		rename `x' `x'_RR
		rename `x'_sig `x'_RR_s
	}
	merge 1:1 geo using "./Data/Comparison lnrr", nogen
	foreach x of global varlist{
		rename `x' `x'_lnRR
		rename `x'_sig `x'_lnRR_s
	}
	merge 1:1 geo using "./Data/Comparison RD", nogen
	foreach x of global varlist{
		rename `x' `x'_RD
		rename `x'_sig `x'_RD_s
	}

	sort_westeast
	drop westeast geoname

	export excel using "./Data/Thesis Tables.xls", sheetreplace sheet("Table 2") firstrow(varlabels)

end

*- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
capture program drop  data_table3
program define  data_table3
*-------------------------------------------------------------------------------------------------------------------------------------------
	// rates over time

	use "./Data/Inequalities Master.dta", clear

	keep census outcome geo rate_all se_all

	rename rate_all rate
	rename se_all se

	reshape wide rate se, i(geo outcome) j(census)

	//determine if years are significantly different than each other

	//2001- 2006
	//calculate difference and se
	gen dif_01_06 = rate2006 - rate2001
	gen se_dif_01_06= sqrt(se2001^2 + se2006^2)

	//calculate p-values
```

```
gen p_value=  2*normal(-abs(dif_01_06/se_dif_01_06))

//indicate statistical significance
gen sig_01_06= ""
replace sig_01_06= "*" if p_value < 0.05
replace sig_01_06= "**" if p_value < 0.01
replace sig_01_06= "***" if p_value < 0.001

//2006- 2011

gen dif_06_11 = rate2011 - rate2006
gen se_dif_06_11= sqrt(se2006^2 + se2011^2)

//calculate p-values
gen p_value_2=  2*normal(-abs(dif_06_11/se_dif_06_11))

//indicate statistical significance
gen sig_06_11= ""
replace sig_06_11= "*" if p_value_2 < 0.05
replace sig_06_11= "**" if p_value_2 < 0.01
replace sig_06_11= "***" if p_value_2 < 0.001

//2001- 2011

gen dif_01_11 = rate2011 - rate2001
gen se_dif_01_11= sqrt(se2001^2 + se2011^2)

//calculate p-values
gen p_value_3=  2*normal(-abs(dif_01_11/se_dif_01_11))

//indicate statistical significance
gen sig_01_11= ""
replace sig_01_11= "*" if p_value_3 < 0.05
replace sig_01_11= "**" if p_value_3 < 0.01
replace sig_01_11= "***" if p_value_3 < 0.001

sort_westeast
drop westeast geoname
drop p_value*
drop sig*

foreach x in 01_06 06_11 01_11{
        gen ci_ul_`x' = dif_`x' + 1.96* se_dif_`x'
        gen ci_ll_`x' = dif_`x' - 1.96* se_dif_`x'
}


drop ci*
```

```
	preserve
		reshape wide rate*  dif_*  se* , i(geo) j(outcome)string

		sort_westeast
		drop westeast geoname

		order rate* se20* dif* se_dif*
		order *2001* *dif_01_06* *2006* *dif_06_11*  *2011* *dif_01_11*

		order *bmhealth *lifestress *mood *anxiety
		order  geo

		export excel using "./Data/Thesis Tables.xls",                          ///
			sheetreplace sheet("Table 3.5") firstrow(varlabels)
	restore
end

*- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
capture program drop  data_table4
program define  data_table4
*-------------------------------------------------------------------------------------------------------------------------------------------------------
	// inequalities over time

	foreach y of global varlist{

		use "./Data/Inequalities Master.dta", clear

		keep census outcome geo CI CI_se rd se_rd lnrr se_lnrr rr rate_all se_all

		rename CI_se se_CI
		rename rate_all rate
		rename se_all se_rate

		keep if outcome == "`y'"

		reshape wide CI se_CI rd  se_rd rr lnrr se_lnrr rate se_rate, i(geo outcome) j(census)

		//determine if years are significantly different than each other

		//2001- 2006

		foreach x in rd CI lnrr{
			//calculate difference and se
			gen dif_01_06_`x' = `x'2006 - `x'2001
			gen se_dif_01_06_`x'= sqrt(se_`x'2001^2 + se_`x'2006^2)

			//calculate p-values
```

```
	gen p_value_`x'=  2*normal(-abs(dif_01_06_`x'/se_dif_01_06_`x'))

	//indicate statistical significance
	gen sig_01_06_`x'= ""
	replace sig_01_06_`x'= "*" if p_value_`x' < 0.05
	replace sig_01_06_`x'= "**" if p_value_`x' < 0.01
	replace sig_01_06_`x'= "***" if p_value_`x' < 0.001

	drop p_value_`x'

}

//2006- 2011

foreach x in rd CI lnrr{
	//calculate difference and se
	gen dif_06_11_`x' = `x'2011 - `x'2006
	gen se_dif_06_11_`x'= sqrt(se_`x'2006^2 + se_`x'2011^2)

	//calculate p-values
	gen p_value_`x'=  2*normal(-abs(dif_06_11_`x'/se_dif_06_11_`x'))

	//indicate statistical significance
	gen sig_06_11_`x'= ""
	replace sig_06_11_`x'= "*" if p_value_`x' < 0.05
	replace sig_06_11_`x'= "**" if p_value_`x' < 0.01
	replace sig_06_11_`x'= "***" if p_value_`x' < 0.001

	drop p_value_`x'
}

//2001- 2011

foreach x in rd CI lnrr{
	//calculate difference and se
	gen dif_01_11_`x' = `x'2011 - `x'2001
	gen se_dif_01_11_`x'= sqrt(se_`x'2001^2 + se_`x'2011^2)

	//calculate p-values
	gen p_value_`x'=  2*normal(-abs(dif_01_11_`x'/se_dif_01_11_`x'))

	//indicate statistical significance
	gen sig_01_11_`x'= ""
	replace sig_01_11_`x'= "*" if p_value_`x' < 0.05
	replace sig_01_11_`x'= "**" if p_value_`x' < 0.01
	replace sig_01_11_`x'= "***" if p_value_`x' < 0.001

	drop p_value_`x'
```

```
		}


		sort_westeast
		drop westeast geoname

		preserve
			drop sig* rate*

			order se*, last
			order outcome geo *CI2001 *dif_01_06_CI *CI2006 *dif_06_11_CI *CI2011
*dif_01_11_CI *rr2001 *dif_01_06_lnrr *rr2006 *dif_06_11_lnrr *rr2011 *dif_01_11_lnrr *rd2001 *dif_01_06_rd
*rd2006 *dif_06_11_rd *rd2011 *dif_01_11_rd

			drop outcome

			export excel using "./Data/Thesis Tables.xls",                    ///
				sheetreplace sheet("Table 4 `y'") firstrow(varlabels)

		restore

	keep geo rate2001 rate2006 rate2011 dif_* sig_*
	order *CI *lnrr *rd
	order geo rate2001 rate2006 rate2011 *_01_06* *_06_11* *_01_11*
	export excel using "./Data/Thesis Tables.xls", sheetreplace sheet("Table 4.5 `y'") firstrow(varlabels)


	}

end

* 5. Graphs
/* - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
	DATA_GRAPH1
	DATA_GRAPH2

	FUNCTION
	Makes excel tables with graph data for presentation in manuscript

	RETURNS
	Theis Graphs:
		Graph 1
		Graph 2

	NOTES
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - */
capture program drop  data_graph1
program define  data_graph1
```

```
*-------------------------------------------------------------------------------------------------------------------------------
	//data for graph 1

	use "./Data/Inequalities Master.dta", clear

	keep if census==2011
	keep if geolevel=="nat"
	keep geo rate* se* outcome

	drop rate_all se_all se_rd se_rr geo se_lnrr

	reshape long rate_ se_, i(outcome) j(quintile)

	rename rate_ rate
	rename se_ se

	gen ci_ul = rate + 1.96* se
	gen ci_ll = rate - 1.96* se

	export excel using "./Data/Thesis Graphs.xls",                    ///
		sheetreplace sheet("Graph 1") firstrow(varlabels)

end

*- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
capture program drop  data_graph2
program define  data_graph2
*-------------------------------------------------------------------------------------------------------------------------------
	// make data for graph comparing concentration index between geography
	// and national average

	use "./Data/Inequalities Master.dta", clear

	keep if census==2011
	keep geo CI CI_se outcome

	sort_westeast
	drop westeast geoname

	preserve
	keep if geo== 999
	gen CI_nat = CI
	gen CI_se_nat= CI_se
	drop CI CI_se
	save "./Data/Graph2 National Data Ref Temp.dta", replace
	restore

	merge m:1 outcome using "./Data/Graph2 National Data Ref Temp.dta", nogen
```

```
	gen dif= CI_nat- CI
	gen dif_se= sqrt(CI_se_nat^2 + CI_se^2)

	sort_westeast
	keep geo dif dif_se outcome

	reshape wide dif dif_se, i(geo) j(outcome, string)
	sort_westeast
	drop westeast geoname *se*

	export excel using "./Data/Thesis Graphs.xls", sheetreplace sheet("Graph 2") firstrow(varlabels)

end
*- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
capture program drop sort_westeast
program define sort_westeast
*------------------------------------------------------------------------------------------------------------------------------------------
	//create variable identifying west to east ordering
	gen westeast= .

	decode geo , generate(geoname)

	replace westeast= 0   if geoname == "Canada"

	replace westeast= 201   if geoname == "Victoria"
	replace westeast= 202   if geoname == "Vancouver"
	replace westeast= 203   if geoname == "Abbotsford - Mission"
	replace westeast= 204   if geoname == "Kelowna"
	replace westeast= 205   if geoname == "Calgary"
	replace westeast= 206   if geoname == "Edmonton"
	replace westeast= 207   if geoname == "Saskatoon"
	replace westeast= 208   if geoname == "Regina"
	replace westeast= 209   if geoname == "Winnipeg"
	replace westeast= 210  if geoname == "Thunder Bay"
	replace westeast= 211  if geoname == "Greater Sudbury / Grand Sudbury"
	replace westeast= 212  if geoname == "Barrie"
	replace westeast= 213  if geoname == "Windsor"
	replace westeast= 214  if geoname == "London"
	replace westeast= 215  if geoname == "Guelph"
	replace westeast= 216  if geoname == "Brantford"
	replace westeast= 217  if geoname == "Kitchener - Cambridge - Waterloo"
	replace westeast= 218  if geoname == "St. Catharines - Niagara"
	replace westeast= 219  if geoname == "Hamilton"
	replace westeast= 220  if geoname == "Toronto"
	replace westeast= 221  if geoname == "Oshawa"
	replace westeast= 222  if geoname == "Peterborough"
	replace westeast= 223  if geoname == "Kingston"
```

```
	replace westeast= 224  if geoname == "Ottawa-Gatineau"
	replace westeast= 225  if geoname == "Montreal"
	replace westeast= 226  if geoname == "Trois-Rivi    res"
	replace westeast= 227  if geoname == "Sherbrooke"
	replace westeast= 228  if geoname == "Quebec"
	replace westeast= 229  if geoname == "Saguenay"
	replace westeast= 230  if geoname == "Saint John"
	replace westeast= 231  if geoname == "Moncton"
	replace westeast= 232  if geoname == "Halifax"
	replace westeast= 233  if geoname == "St. Johns"

	replace westeast= 110 if geoname == "Newfoundland and Labrador"
	replace westeast= 109 if geoname == "Prince Edward Island"
	replace westeast= 108 if geoname == "Nova Scotia"
	replace westeast= 107 if geoname == "New Brunswick"
	replace westeast= 106 if geoname == "Quebec" & geo == 24
	replace westeast= 105 if geoname == "Ontario"
	replace westeast= 104 if geoname == "Manitoba"
	replace westeast= 103 if geoname == "Saskatchewan"
	replace westeast= 102 if geoname == "Alberta"
	replace westeast= 101 if geoname == "British Columbia"

	//sort west to east
	sort westeast

end

*- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
* XX. Control
*------------------------------------------------------------------------------------------------------------------------------------------
//list of globals
global varlist bmhealth lifestress mood anxiety
global geo nat prov cma

//  1. Create Geographies based on Census data
	make_geonames
//  2. Open and reformat data
	open_data
//  3. Finalize estimates
	make_data
//  4. Generate comparisons between geographies and over time
	gen_comparison
//  5. Create data for tables
	data_table1
	data_table2
	data_table3
	data_table4
//  6. Create data for graphs
```

```
        data_graph1
        data_graph2

exit
```

Appendix F: Stata Code - Manuscript 2

```
//23456789#123456789#123456789#123456789#123456789#123456789#123456789#123456789
//
//Measuring Trends in Mental Health and Addictions Thesis: CCHS ANALYSIS
//===============================================================================
//Programmer: Sharalynn Missiuna
//Task: Merge, Harmonize and recode variables from the mental health components
//                    of the CCHS in 2012 with census data from 2011. Conduct a multiple
//                    logistic regression using the resulting combined dataset
//Date Started: October 10, 2019
//Last Edited:  January 23, 2020
//===============================================================================

//Details
//===============================================================================
//Steps
//  0. Setup
//  1. Open and rename variables in CCHS MH 2012
//   2. Recode CCHS MH 2012
//  3. Open and rename variables in 2011 census
//  4. Recode Census 2011
//  5. Merge CCHS and Census. generate needed variables
//  6. Calculate descriptive statistics for covariates
//  7. Calculate descriptive statistics for outcomes
//  8. Calculate odds ratios by implementing a simple regression of each covariate against each outcome
//  9. construct models using multiple logistic regression
//  XX. Control

//Inputs
//  1. CCHS 2012 MH, Census 2011

//Outputs
//  1.

//===============================================================================

 /* - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -

        VARIABLES

        Outcome variables:
        Any             lifetime prevalence of substance mood or anxiety disorders      (dichotomous)
        Substance       lifetime prevalence of drug and alcohol use disorder            (dichotomous)
        Drug            lifetime prevalence of any drug use disorders                   (dichotomous)
        Alcohol         lifetime prevalence of any alcohol use disorders                (dichotomous)
        Mood            lifetime prevalence of depression and bipolar disorder          (dichotomous)
```

```
	Depression	lifetime prevalence of depression				(dichotomous)
	Bipolar		lifetime prevalence of bipolar disorder		(contains mania and hypomania)
	Mania		lifetime prevalence of a manic episode			(dichotomous)
	Hypomania	lifetime prevalence of a hypomania episode		(dichotomous)
	Anxiety		lifetime prevalence of an anxiety disorder		(dichotomous)

	Demographic Variables
	da		dissemination area (neighbourhood)			(categorical)
	cma		census metropolitan area (city)				(categorical)
	prov		province						(categorical)
	nat		national						(categorical)

	Logistic regression variables
	Demographics:
	age		age							(categorical)
	sex		sex							(dichotomous)

	Socioeconomic Status:
	quintile_ind	adjusted income quintile at the individual level	(categorical)
	quintile_da	adjusted income quintile a the dissemination area level	(categorical)
	education	level of education of individual			(categorical)
	employment	employed in the last week				(dichotomous)

	Culture:
	immigrant_length length of time immigrant in Canada		(categorical)
	ethnicity	ethnicity of individual					(categorical)

	Lifestyle:
	maritalstatus	marital status						(categorical)
	household_type household type					(categorical)

	Other:
	sexuality	heterosexual vs homosexual or bisexual			(dichotomous)
	chronic_condition presence of chronic condition			(dichotomous)

	Mental Health:
	positive_mh	positive mental health measure				(dichotomous)
	community_belonging feels like belongs to community		(dichotomous)


- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -- - - - - - */
* 0. Setup
*-----------------------------------------------------------------------------------------------------------------------------------------------

//name project
	local project "CCHSMH_Harmonize_March2019"

//global settings
```

```
	set more off, permanently
	clear all

//set ado path
	adopath + "P:\Proj-18-SSH-SKY-5853_Neudorf_Missiuna_Plante\ADO"

//set directory
	global mydata "P:\Proj-18-SSH-SKY-5853_Neudorf_Missiuna_Plante\MHInequalities\Data\Regression"

//open log

	capture log close main
	local date= subinstr(c(current_date)," ","",.)
	log using "P:\Proj-18-SSH-SKY-5853_Neudorf_Missiuna_Plante/Log/`filename'_`date'.log", name(main)
replace

//set graph scheme
	set scheme s1color


* 1. Get CCHS 2012 MH
/* - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
	GET_CCHS

	FUNCTION
	Open, reduce, and rename variables needed in CCHS 2012


	RETURNS
	cchs_2012_reduced.dta

	NOTES
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - */
capture program drop get_cchs
program get_cchs
*------------------------------------------------------------------------------------------------------------------------------------------

	//use raw CCHS 2012 mental health file
	use "$mydata\CCHS_MH_2012.dta", clear

	//drop unneeded variables
	keep SAMPLEID DEPDDPS MIADEPS AUDDLA BIPDL GADDGDS PMHDCLA GEN_10	///
		HYPDL SUDDL MHPFL  MHPFLM  MHPFLSA  SDC_5A_1 SDC_7AA		///
		EDUDR04 LBSDWSS DHH_MS DHH_AGE DHH_SEX WTS_M INC_3  GEODCMA1  ///
		SDCDRES DHHDHSZ GEODDA11 SDCDCGT CCCF1 DHHDECF

	//merge with boostrap variables
	merge m:1 SAMPLEID using "$mydata\CCHS_MH_2012_BS.dta", nogen
```

```
	drop SAMPLEID

	// rename variables

	//demographic variables
	rename WTS_M			weight
	rename GEODDA11			da
	rename GEODCMA1			cma_r

	//outcome variables
	rename DEPDDPS			depression_r
	rename MIADEPS			mania_r
	rename AUDDLA			alcohol_r
	rename BIPDL			bipolar_r
	rename GADDGDS			anxiety_r
	rename HYPDL			hypomania_r
	rename SUDDL			drug_r
	rename MHPFL			any_r
	rename MHPFLM			mood_r
	rename MHPFLSA			substance_r

	// logistic regression variables
	rename SDC_5A_1			language_r
	rename SDC_7AA			sexuality_r
	rename EDUDR04			education_r
	rename LBSDWSS			employment_r
	rename DHH_MS			maritalstatus_r
	rename DHH_AGE			age_r
	rename DHH_SEX			sex_r
	rename INC_3			income_ind
	rename DHHDHSZ			house_size_r
	rename SDCDRES			length_canada_r
	rename SDCDCGT			ethnicity_r
	rename CCCF1			chronic_condition_r
	rename DHHDECF			household_type_r
	rename PMHDCLA			positive_mh_r
	rename GEN_10			community_belonging_r

	//clean up and save
	compress
	save "$mydata\cchs_2012_reduced.dta", replace

end

* 2. Recode CCHS 2012
/* - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
	RECOD_CCHS
```

```
	FUNCTION
	Recode variables in CCHS to useable


	RETURNS
	cchs_2012_recode.dta

	NOTES
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - */
capture program drop recode_cchs
program define recode_cchs
*------------------------------------------------------------------------------------------------------------------------------------------------------


	//open harmonized data set
	use "$mydata\cchs_2012_reduced.dta", clear

	// drop non cmas from analysis
	drop if cma==0

	//recode outcome variables into dichotomous form
	foreach w of global outcome {
		gen `w'= .
		replace `w' =0 if `w'_r ==2
			//no, does not have outcome
		replace `w' =1 if `w'_r ==1
			//yes, has outcome
	}

	// recode education into 4 categories
	gen education=.
	replace education=1 if education_r==4				//post-secondary graduation
	replace education=2 if education_r==3				//some post-secondary
	replace education=3 if education_r==2				//secondary school graduation
	replace education=4 if education_r==1				//less than secondary school
graduation

	//recode sex into dichotomous
	gen sex=.
	replace sex =1 if sex_r==1						//male
	replace sex =2 if sex_r==2						//female

	// recode sexuality
	gen sexuality = .
	replace sexuality = 1 if sexuality_r == 1				//heterosexual
	replace sexuality = 2 if inrange(sexuality_r, 2,3)		//homosexual or bisexual

	// recode marriage status into categorical
```

```
gen maritalstatus =.
replace maritalstatus = 1 if inrange(maritalstatus_r, 1,2)          //married or common law
replace maritalstatus = 2 if inrange(maritalstatus_r, 3,5)          //widowed, separated, divorced
replace maritalstatus = 3 if maritalstatus_r == 6                   //single never married

// recode time since immigration
gen immigrant_length =.
replace immigrant_length= 1 if length_canada ==996                  //not immigrant
replace immigrant_length= 2 if inrange(length_canada, 0,2)          //in canada 0-2 years
replace immigrant_length= 3 if inrange(length_canada, 3,10)         //in canada 3-10 years
replace immigrant_length= 4 if inrange(length_canada, 11,20)        //in canada 11-20 years
replace immigrant_length= 5 if inrange(length_canada, 21,94)        //in canada 21+ years

// recode employment into dichotomous variable
gen employment =.
replace employment =1 if inlist(employment_r, 1,2)                  //had a job last week
replace employment =2 if inlist(employment_r, 3,4)                  //did not have a job last week

//recode ethnicity into 7 categories
gen ethnicity=.
replace ethnicity =1 if ethnicity_r==1                              //white
replace ethnicity =2 if ethnicity_r==2                              //black
replace ethnicity =3 if inlist(ethnicity_r, 3,4,5,6,7,8,10)         //asian
replace ethnicity =4 if ethnicity_r==9                              //arab
replace ethnicity =5 if ethnicity_r==11                             //latin american
replace ethnicity =6 if ethnicity_r==96                             //aboriginal
replace ethnicity =7 if inlist(ethnicity_r, 12,13)                  //other or multiple

// recode chronic conditions into dichotomous variable
gen chronic_condition =.
replace chronic_condition =1 if chronic_condition_r ==2             //no chronic condition
replace chronic_condition =2 if chronic_condition_r ==1             //has chronic condition

// recode positive mental health
gen positive_mh =.
replace positive_mh = 1 if positive_mh_r == 1                       //flourishing mental health
replace positive_mh = 2 if positive_mh_r == 2                       //languishing mental health
replace positive_mh = 3 if positive_mh_r == 3                       //moderate mental health

// recode community belonging into 2 categories
gen community_belonging=.
replace community_belonging =1 if inlist(community_belonging_r, 1,2)        //somewhat strong or very
strong sense of community belonging
replace community_belonging =2 if inlist(community_belonging_r, 3,4)        //somewhat weak or very
weak sense of community belonging


//recode household type
```

```
gen household_type=.
replace household_type= 1 if inlist(household_type_r,3)              //couple alone
replace household_type= 2 if inlist(household_type_r,1)              //individual alone
replace household_type= 3 if inrange(household_type_r,9,16)          //individual with children
replace household_type= 4 if inrange(household_type_r,5,8)           //couple with children
replace household_type= 5 if inlist(household_type_r,2,4,17)         //other

//recode age as continuous
gen age=.
replace age= 1  if inrange(age_r,25,44)
replace age= 2  if inrange(age_r,15,24)
replace age= 3  if inrange(age_r,45,64)
replace age= 4 if age>=65

//DEMOGRAPHIC VARIABLES
gen cma =.
replace  cma = 1  if cma_r == 535                                    //toronto
replace  cma = 2  if cma_r == 1                                      //st johns
replace  cma = 3  if cma_r == 205                                    //halifax
replace  cma = 4  if cma_r == 305                                    //moncton
replace  cma = 5  if cma_r == 310                                    //saint john
replace  cma = 6  if cma_r == 408                                    //saguenay
replace  cma = 7  if cma_r == 421                                    //quebec
replace  cma = 8  if cma_r == 433                                    //sherbrooke
replace  cma = 9  if cma_r == 442                                    //trois-rivires
replace  cma = 10 if cma_r == 462                                    //montreal
replace  cma = 11 if cma_r == 505                                    //ottawa-gatineau
replace  cma = 12 if cma_r == 521                                    //kingston
replace  cma = 13 if cma_r == 529                                    //petersbourgh
replace  cma = 14 if cma_r == 532                                    //oshawa
replace  cma = 15 if cma_r == 537                                    //hamilton
replace  cma = 16 if cma_r == 539                                    //st catherines-niagara
replace  cma = 17 if cma_r == 541                                    //kitchener
replace  cma = 18 if cma_r == 543                                    //brantford
replace  cma = 19 if cma_r == 550                                    //guelph
replace  cma = 20 if cma_r == 555                                    //london
replace  cma = 21 if cma_r == 559                                    //windsor
replace  cma = 22 if cma_r == 568                                    //barrie
replace  cma = 23 if cma_r == 580                                    //greater sudbury- grand sudbury
replace  cma = 24 if cma_r == 595                                    //thunder bay
replace  cma = 25 if cma_r == 602                                    //winnipeg
replace  cma = 26 if cma_r == 705                                    //regina
replace  cma = 27 if cma_r == 725                                    //saskatoon
replace  cma = 28 if cma_r == 825                                    //calgary
replace  cma = 29 if cma_r == 835                                    //edmonton
replace  cma = 30 if cma_r == 915                                    //kelowna
replace  cma = 31 if cma_r == 932                                    //abbotsford
replace  cma = 32 if cma_r == 933                                    //vancouver
```

```
	replace  cma = 33 if cma_r == 935					//victoria

	//generate dummy variables for cma
	levelsof cma, local(cmacodes)
	foreach i of local cmacodes{
		gen cma_`i'= (cma == `i')
	}



	//generate national variable
	gen nat = 1

	//generate adjusted income
	gen income_adj_ind = income_ind/ sqrt(house_size)

	//clean up file
	drop *_r FWGT

	order da cma nat ///
	age sex ///
	income_ind income_adj_ind education employment ///
	immigrant_length ethnicity  ///
	chronic_condition sexuality maritalstatus household_type ///
	positive_mh community_belonging ///
	mood  anxiety substance  any ///
	weight

	compress
	save "$mydata\cchs_2012_recode.dta", replace
end


* 3. Open Census 2011
/* - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
	GET_CENSUS

	FUNCTION
	Open and reduce census data


	RETURNS
	census_2011_reduce.dta

	NOTES
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - */
capture program drop get_census
program define get_census
```

```
*-------------------------------------------------------------------------------------------------------------------------------

	//open census data
	use "$mydata\Census_2011.dta", clear

	//keep variables that are needed
	keep pop_cntr_ind doctp prcdda cma hmain hhinc nunits compw2

	//rename variables
	rename	pop_cntr_ind		pop_cntr
	rename	doctp			doc_type		//questionnaire type
	rename	prcdda			da			//dissemination area
	rename	cma			cma			//census metro area

	rename	hmain			main			//primary breadwinner
	rename	hhinc			hhttinc			//household total income
	rename	nunits			hhsize			//household size

	rename	compw2			weight			//probability weight

	save "$mydata\census_2011_reduce.dta", replace
end


* 4. Recode Census 2011
/* - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
	RECODE_CENSUS

	FUNCTION
	Open and recode census data


	RETURNS
	census_2011_recode.dta

	NOTES
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - */
capture program drop recode_census
program define recode_census
*-------------------------------------------------------------------------------------------------------------------------------
	use "$mydata\census_2011_reduce.dta", clear

	//recode variables as needed (2011)
	gen private= inlist(doc_type,2,9) if !missing(doc_type)		//boolean private dwellings
	gen primary= inlist(main,1) if !missing(main)			//boolean primary breadwinner
	gen urban= inlist(pop_cntr,2,3,4) if !missing(main)		//boolean urban based on pop centre
	gen hhsize_adj= sqrt(hhsize)					//adjusted household size
```

```
	//keep only urban population
	keep if private				//reduce to private dwellings using questionnaire type
	keep if primary				//reduce to household level by selecting for main breadwinner
	keep if urban				//reduce to urban observations

	//collapse to DA level
	collapse (sum) pop=hhsize pop_adj=hhsize_adj total_hhttinc=hhttinc		///
		(first) cma[pw=weight], by(da)

	//calculate DA average equivalent incomes
	gen avg_hheqinc_tt= total_hhttinc/pop_adj

	//code quintiles(wealthiest quintile as 5 and the least as 1)
	bysort  cma: egen quintile= xtile(avg_hheqinc_tt), nquantiles(5) weight(pop)

	rename avg_hheqinc_tt income_da

	// keep only variables needed
	keep quintile da income_da

	//clean up and save
	compress
	save "$mydata\census_2011_recode.dta", replace

end

* 5. Merge CCHS and Census
/* - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
	MERGE_CCHS_CENSUS

	FUNCTION
	Merge recoded versions of CCHS and Census


	RETURNS
	regression_data_use.dta

	NOTES
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - */
capture program drop merge_cchs_census
program define merge_cchs_census
*------------------------------------------------------------------------------------------------------------------------------------

	//open the CCHS
	use "$mydata\cchs_2012_recode.dta", clear

	//merge census
	merge m:1 da using "$mydata\census_2011_recode.dta", nogen keep( 3)
```

```
	//generate indiviudal income quintile
	bysort cma: egen quintile_ind= xtile(income_adj_ind), 		nquantiles(5) weight(weight)

	//clean up file
	drop income_ind
	rename income_adj_ind 		income_ind
	rename quintile 			quintile_da

	order 														///
		da cma nat age sex 											///
		quintile_ind quintile_da education employment 				///
		immigrant_length ethnicity 									///
		chronic_condition sexuality 								///
		maritalstatus household_type 								///
		positive_mh community_belonging 							///
		mood anxiety substance any 									///
		weight

	//recode quintiles to opposite
	gen quintile_ind_opp=.
	replace  quintile_ind_opp =1 if  quintile_ind ==5
	replace  quintile_ind_opp =2 if  quintile_ind ==4
	replace  quintile_ind_opp =3 if  quintile_ind ==3
	replace  quintile_ind_opp =4 if  quintile_ind ==2
	replace  quintile_ind_opp =5 if  quintile_ind ==1

	drop quintile_ind
	rename quintile_ind_opp quintile_ind

	gen quintile_da_opp=.
	replace  quintile_da_opp =1 if  quintile_da ==5
	replace  quintile_da_opp =2 if  quintile_da ==4
	replace  quintile_da_opp =3 if  quintile_da ==3
	replace  quintile_da_opp =4 if  quintile_da ==2
	replace  quintile_da_opp =5 if  quintile_da ==1

	drop quintile_da
	rename quintile_da_opp quintile_da

	//clean up and save
	compress
	save "$mydata\regression_data_use.dta", replace

end

* 6. Calculate Prevalence of Covariates at National Level
/* - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
```

```
    PREV_COVARIATE

    FUNCTION
    Calculate descriptive statistics for covariates


    RETURNS

    NOTES
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - */
capture program drop prev_covariate
program define prev_covariate
*----------------------------------------------------------------------------------------------------------------------------------------------------------

    //unweighted
    foreach y of global outcome{

        foreach x of global covariate{

            use  "$mydata\regression_data_use.dta", clear

            drop if missing(`y')

            gen n= 1

            collapse (sum) n, by(`x')

            rename `x' level
            gen covariate = "`x'"

            keep if !missing(level)

            rename n event_u

            preserve
                collapse (sum)event_u (first)covariate
                rename event_u obs_u
                save "$mydata\obs_temp.dta", replace
            restore

            merge m:1 covariate using "$mydata\obs_temp.dta", nogen

            save "$mydata\descriptive\covariate\`y'_`x'_u", replace
        }
    }

    //merge unweighed
    foreach y of global outcome{
```

```
	use "$mydata\descriptive\covariate\`y'_age_u",clear

	foreach x in cma sex quintile_ind quintile_da education employment ///
		immigrant_length ethnicity maritalstatus household_type ///
		community_belonging sexuality chronic_condition positive_mh{

		append using "$mydata\descriptive\covariate\`y'_`x'_u"
	}
	rename obs_u d_u
	rename event_u n_u
	order covariate level n_u d_u
	save "$mydata\descriptive\covariate\`y'_release_u", replace
}

use "$mydata\descriptive\covariate\ any_release_u", clear
merge 1:1 covariate level using "$mydata\descriptive\covariate\ mood_release_u",nogen
merge 1:1 covariate level using "$mydata\descriptive\covariate\ anxiety_release_u",nogen
merge 1:1 covariate level using "$mydata\descriptive\covariate\ substance_release_u",nogen

save  "$mydata\descriptive\covariate\descriptive_support_unweighted", replace


//weighted
foreach y of global outcome{

	foreach x  of global covariate{
		use "$mydata\regression_data_use.dta", clear

		drop if missing(`y')

		gen n= 1

		collapse (sum) n  [pw=weight], by(`x')

		rename `x' level
		gen covariate = "`x'"

		keep if !missing(level)

		rename n event_w

		preserve
			collapse (sum)event_w (first)covariate
			rename event_w obs_w
			save "$mydata\obs_temp.dta", replace
		restore

		merge m:1 covariate using "$mydata\obs_temp.dta", nogen
```

```
		gen obs_r= round(obs_w,50)
		gen event_r= round(event_w,50)

		gen rate_r = event_r/obs_r

		save "$mydata\descriptive\covariate\`y'_`x'_w", replace

	}
}

//merge weighted

foreach y of global outcome{
	use "$mydata\descriptive\covariate\`y'_age_w",clear

	foreach x in cma sex quintile_ind quintile_da education employment ///
		immigrant_length ethnicity maritalstatus household_type ///
		community_belonging sexuality chronic_condition positive_mh{

		append using "$mydata\descriptive\covariate\`y'_`x'_w"
	}

	order covariate level rate
//	keep covariate level rate_r event_r
	rename rate_r rate_`y'
	rename event_r n_`y'
	save "$mydata\descriptive\covariate\`y'_release_w", replace
}

use "$mydata\descriptive\covariate\ any_release_w", clear
merge 1:1 covariate level using "$mydata\descriptive\covariate\ mood_release_w",nogen
merge 1:1 covariate level using "$mydata\descriptive\covariate\ anxiety_release_w",nogen
merge 1:1 covariate level using "$mydata\descriptive\covariate\ substance_release_w",nogen


//save rounded version for combination with simple regression file
preserve
	//reduce file
	keep covariate level rate_any n_any

	//rename variables
	rename rate_any percentage
	rename n_any n

	//save file
	save "$mydata\descriptive\covariate\ descriptives_release", replace
restore
```

```
	//save support document

	//reduce file
	keep covariate level event_w obs_w

	//rename variables
	rename event_w n_w
	rename obs_w d_w

	//merge unweighted file with unrounded file
	merge 1:1 covariate level using  "$mydata\descriptive\covariate\descriptive_support_unweighted", nogen

	//save file
	save  "$mydata\descriptive\covariate\descriptive_support_master", replace
	export excel using  "$mydata\descriptives support",                                    ///
		firstrow(variables)sheet("descriptives",replace)

	end

* 7. Calculate Prevalence of Outcome at National Level
/* - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
	PREV_OUTCOME

	FUNCTION
	Calculate descriptive statistics for covariates


	RETURNS

	NOTES
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - */
capture program drop prev_outcome
program define prev_outcome
*-------------------------------------------------------------------------------------------------------------------------------
	//unweighted
	foreach y of global outcome{

		use  "$mydata\regression_data_use.dta", clear

		keep `y'

		drop if missing(`y')

		gen d_u= 1

		gen n_u=.
		replace n_u=1 if `y' ==1
```

```
		collapse (sum) n_u d_u

		gen outcome = "`y'"

		order outcome n_u d_u

		save "$mydata\descriptive\outcome\`y'_u", replace

}

//merge unweighed
use "$mydata\descriptive\outcome\ mood_u", clear
append using  "$mydata\descriptive\outcome\ anxiety_u",
append using  "$mydata\descriptive\outcome\ substance_u",
append using  "$mydata\descriptive\outcome\ any_u",


save  "$mydata\descriptive\outcome\descriptive support unweighted", replace

//weighted

foreach y of global outcome{

		use  "$mydata\regression_data_use.dta", clear

		keep `y' weight

		drop if missing(`y')

		gen d_w= 1

		gen n_w=.
		replace n_w=1 if `y' ==1

		collapse (sum) n_w d_w [pw=weight]

		gen outcome = "`y'"

		order outcome n_w d_w

		gen n_r= round(n_w,50)
		gen d_r= round(d_w,50)

		gen rate_r = n_r/d_r

		save "$mydata\descriptive\outcome\`y'_w", replace
```

```
	}

	//merge weighed
	use "$mydata\descriptive\outcome\ mood_w", clear
	append using  "$mydata\descriptive\outcome\ anxiety_w",
	append using  "$mydata\descriptive\outcome\ substance_w",
	append using  "$mydata\descriptive\outcome\ any_w",


	save  "$mydata\descriptive\outcome\descriptive weighted", replace

	merge 1:1 outcome using  "$mydata\descriptive\outcome\descriptive support unweighted", nogen

	order outcome n_u d_u n_w d_w n_r d_r rate_r

	export excel using  "$mydata\descriptive\outcome\descriptives support",			///
				firstrow(variables)sheet("descriptives",replace)

	keep outcome n_r d_r rate_r

	export excel using  "$mydata\descriptive\outcome\descriptives release",			///
				firstrow(variables)sheet("descriptives",replace)


end

* 8. Simple Regression
/* - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
	SIMPLE_REGRESSION

	FUNCTION
	simple logistic regression models


	RETURNS

	NOTES
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - */
capture program drop simple_regression
program define simple_regression
*------------------------------------------------------------------------------------------------------------------------------------------------------
	//simple regression support

	//open dataset
	use "$mydata\regression_data_use.dta", clear

	//generate dummy variables for outcome variables
	foreach x of global outcome{
```

```
		foreach y of global covariate{
			preserve
			gen `x'_0 = 1 if `x' ==0 & !missing(`y')
			gen `x'_1 = 1 if `x' ==1 & !missing(`y')
			collapse (sum) `x'_0 `x'_1, by(`y')
			rename `y' level
			gen covariate = "`y'"

			save "$mydata\descriptive\covariate\`y'_`x'_u", replace
			restore
		 }
}

foreach x of global outcome{
		use"$mydata\descriptive\covariate\blank",clear
		foreach y of global covariate{
			append using "$mydata\descriptive\covariate\`y'_`x'_u",
		}
		save "$mydata\descriptive\covariate\`x'_u", replace
}

use "$mydata\descriptive\covariate\ mood_u", clear
merge 1:1 covariate level using "$mydata\descriptive\covariate\ anxiety_u", nogen
merge 1:1 covariate level using "$mydata\descriptive\covariate\ substance_u", nogen
merge 1:1 covariate level using "$mydata\descriptive\covariate\ any_u", nogen

drop if missing(level)

export excel using  "$mydata\bivariate regression support", firstrow(variables)sheet("descriptives",replace)


//calculate simple regression

use "$mydata\regression_data_use.dta", clear

//set boostrapping information
svyset [pweight=weight], bsrweight(BSW1- BSW500) vce(bootstrap) dof(500) mse

//categorical variables

foreach z of global outcome{
		foreach x in quintile_da quintile_ind{

			svy: logistic `z' i.`x'

			preserve
				matrix simple_logit = r(table)
```

```
                distinct `x'

                drop da-quintile_da

                //tostring covariate, replace

                gen level=.
                gen beta=.
                gen SE=.
                gen p_value=.
                gen CI_LL=.
                gen CI_UL=.

                foreach n of numlist 1/`r(ndistinct)' {
                        set obs `n'
                        replace level= `n' in `n'
                        replace beta= simple_logit[1,`n'] in `n'
                        replace SE=simple_logit[2,`n'] in `n'
                        replace p_value=simple_logit[4,`n'] in `n'
                        replace CI_LL=simple_logit[5,`n'] in `n'
                        replace CI_UL=simple_logit[6,`n'] in `n'
                }
                gen covariate= "`x'"
                order covariate level beta SE p_value CI_LL CI_UL

                save "$mydata\simple regression\simple_logit_`z'_`x'", replace
        restore
    }
}

//append files by outcome
foreach z of global outcome{
    use "$mydata\simple regression\blank", clear

    foreach x of global covariate{
        append using "$mydata\simple regression\simple_logit_`z'_`x'"
    }
    rename beta     beta_`z'
    rename SE       SE_`z'
    rename p_value  p_value_`z'
    rename CI_LL    CI_LL_`z'
    rename CI_UL    CI_UL_`z'

    drop if missing(level)
    save "$mydata\simple regression\simple_logit_`z'", replace
}

//merge outcomes
```

```
	use "$mydata\simple regression\simple_logit_any", clear
	merge 1:1 covariate level using "$mydata\simple regression\simple_logit_mood", nogen
	merge 1:1 covariate level using "$mydata\simple regression\simple_logit_anxiety", nogen
	merge 1:1 covariate level using "$mydata\simple regression\simple_logit_substance", nogen

	foreach x of global outcome{
	gen sig_`x' =""
	replace sig_`x' ="*" if p_value_`x' <0.05
	}

	keep covariate level beta* SE* sig*
	rename beta* OR*

	order covariate level OR_any SE_any sig_any OR_mood SE_mood sig_mood ///
		OR_anxiety SE_anxiety sig_anxiety OR_substance SE_substance sig_substance

	save"$mydata\simple regression\simple_logit_master", replace

	//make of descriptives plus odds ratio for export
	use "$mydata\simple regression\simple_logit_master", clear

	merge 1:1 covariate level using "$mydata\descriptive\covariate\ descriptives_release", nogen
	sort covariate level
	order covariate level percentage n

	export excel using  "$mydata\descriptives release",			///
				firstrow(variables)sheet("descriptives",replace)
end



* 8. Multiple Regression
/* - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
	MULTIPLE_REGRESSION

	FUNCTION
	multiple logistic regression models


	RETURNS

	NOTES
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - */
capture program drop multiple_regression
program define multiple_regression
*-----------------------------------------------------------------------------------------------------------------------------------------
	//open first dataset
	use "$mydata\regression_data_use.dta", clear
```

```
//set bootstrap  information
svyset [pweight=weight], bsrweight(BSW1- BSW500) vce(bootstrap) dof(500) mse

foreach x of global outcome{

	*base
	svy: logistic `x'                                                    ///
		$base

	logistic any $base [pw=weight]


	eststo combined1, t(base) noc

	*base and ses
	svy: logistic `x'                                                    ///
		$base    $ses

	eststo combined2, t(base ses) noc

	*base ses culture
	svy: logistic `x'                                                    ///
		$base    $ses  $culture

	eststo combined3, t(base ses culture) noc

	*base ses culture homelife
	svy: logistic `x'                                                    ///
		$base    $ses $culture $homelife

	eststo combined4, t(base ses culture homelife) noc

	*base ses culture, homelife, other
	svy: logistic `x'                                                    ///
		$base $ses $culture $homelife $other

	eststo combined5, t(base ses culture homelife other) noc


	*base ses culture, homelife, other, mh predictors
	svy: logistic `x'                                                    ///
		$base $ses $culture $homelife $other $mh

	eststo combined6, t(base ses culture homelife other mh) noc


	*all + interactions
```

```
		svy: logistic `x'                                                    ///
			$base $ses $culture $homelife $other                         ///
			i.sex#i.maritalstatus i.sex#i.household_type

		eststo combined7, t(interactions 1) noc


		*all + interactions
		svy: logistic `x'                                                    ///
			$base $ses $culture $homelife $other                         ///
			i.sex#i.maritalstatus i.sex#i.household_type                 ///
			i.sex#i.sexuality

		eststo combined8, t(interactions 2) noc

		*all + interactions
		svy: logistic `x'                                                    ///
			$base $ses $culture $homelife $other $mh                     ///
			 i.sex#i.maritalstatus i.sex#i.household_type                ///
			i.sex#i.sexuality

		eststo combined9, t(interactions 2) noc


		esttab combined1 combined2 combined3 combined4 combined5 combined6 combined7
combined8 combined9, eform cells(b(star) se(par)),using "$mydata\regression\logit_combined_`x'.csv", replace

	}


	//additional models based on statistics of combined 1-9

	svy: logistic mood                                                       ///
		$base $ses $culture $other
	eststo extra1, t(mood 1) noc

	svy: logistic mood                                                       ///
		$base $ses $culture $other                                           ///
		 $base $ses $culture $other  $mh
	eststo extra2, t(mood 2) noc

		svy: logistic anxiety                                               ///
		 $base $ses $culture $homelife $other                               ///
		 i.sex#i.household_type
	eststo extra3, t(anxiety 1) noc

esttab extra1 extra2 extra3, eform cells(b(star) se(par)),using "$mydata\regression\extra regressions 1.csv", replace
```

```
//additional models based on meeting with Dr. Pahwa

svy: logistic mood                                                              ///
        $base $ses $culture $homelife $other                                    ///
        i.sex#i.household_type

eststo extra21, t(mood 1) noc

svy: logistic substance                                                         ///
        $base $ses $culture $homelife $other $mh                                ///
        i.sex#i.maritalstatus i.sex#i.household_type

eststo extra22, t(substance 1) noc


svy: logistic any                                                               ///
        $base $ses $culture $homelife $other                                    ///
        i.sex#i.maritalstatus i.sex#i.household_type

eststo extra23, t(any 1) noc


esttab extra21 extra22 extra23, eform cells(b(star) se(par)),using "$mydata\regression\extra regressions
2.csv", replace

//graph interactions that will be in final models
svy:  logistic substance                                                        ///
        $base $ses $culture $homelife $other $mh                                ///
        i.sex#i.maritalstatus i.sex#i.household_type

margins i.sex#i.maritalstatus
marginsplot

margins  i.sex#i.household_type
marginsplot


svy: logistic any                                                               ///
        $base $ses $culture $homelife $other                                    ///
        i.sex#i.maritalstatus i.sex#i.household_type

eststo extra23, t(any 1) noc

margins i.sex#i.maritalstatus
marginsplot

margins  i.sex#i.household_type
marginsplot
```

```
end


* XX. Control
*-------------------------------------------------------------------------------------------------------------------------------

//define globals
global outcome_extended mood depression mania hypomania bipolar anxiety substance alcohol drug any
global outcome mood anxiety substance any
global covariate cma age sex quintile_da quintile_ind  education employment immigrant_length ethnicity
chronic_condition sexuality maritalstatus household_type positive_mh community_belonging
global cmas cma_2-cma_33

//groupings for multiple logistic regression
global base i.age i.sex i.cma i.quintile_da
global culture i.immigrant_length i.ethnicity
global ses i.quintile_ind i.education i.employment
global homelife i.maritalstatus i.household_type
global other i.chronic_condition  i.sexuality
global mh i.positive_mh  i.community_belonging

//  0. Setup
//  1. Open and rename variables in CCHS MH 2012
        get_cchs
//  2. Recode CCHS MH 2012
        recode_cchs
//  3. Open and rename variables in 2011 census
        get_census
//  4. Recode Census 2011
        recode_census
//  5. Merge CCHS and Census. generate needed variables
        merge_cchs_census
//   6. descriptive statistics for covariates
        prev_covariate
//  7. prevalence statistics for outcome variables
        prev_outcome
//  8. simple regression of each covariate against each outcome
        simple_regression
//  9. logistic regression
        multiple_regression



exit
```

Appendix G: Manuscript 1 Extended Data Tables

Change in Rates of Poor Mental Health Over Time

	Poor Mental Health											
	2001 - 2005		2001-2005 to 2006 - 2011		2006 - 2010		2006 - 2010 to 2011- 2015		2011 - 2015		2001 - 2005 to 2011-2015	
	Prevalence Rate (SE)		Difference in Prevalence Rate (SE)		Prevalence Rate (SE)		Difference in Prevalence Rate (SE)		Prevalence Rate (SE)		Difference in Prevalence Rate (SE)	
Canada	25.8	(0.2)	-0.5	(0.3)	25.3	(0.2)	2.6	(0.3)	27.9	(0.2)	2.1	(0.3)
Province												
British Columbia	29.1	(0.5)	-0.6	(0.7)	28.5	(0.5)	3.5	(0.8)	32	(0.6)	2.9	(0.8)
Alberta	24.8	(0.6)	-0.2	(0.9)	24.6	(0.6)	1.6	(0.8)	26.2	(0.6)	1.4	(0.8)
Saskatchewan	24.4	(0.9)	3	(1.3)	27.4	(1)	1.9	(1.5)	29.3	(1.1)	4.9	(1.5)
Manitoba	25.8	(0.9)	2.9	(1.4)	28.7	(1)	1.9	(1.4)	30.6	(0.9)	4.8	(1.3)
Ontario	26.8	(0.3)	-1.4	(0.5)	25.4	(0.3)	2.8	(0.5)	28.2	(0.3)	1.4	(0.5)
Quebec	23.1	(0.4)	-0.1	(0.6)	23	(0.4)	2.4	(0.6)	25.4	(0.4)	2.3	(0.6)
New Brunswick	29.6	(2)	-0.7	(2.3)	28.9	(1.2)	2.7	(1.7)	31.6	(1.3)	2	(2.4)
Nova Scotia	23.2	(1.2)	-0.3	(1.8)	22.9	(1.3)	4.7	(1.8)	27.6	(1.2)	4.4	(1.7)
Newfoundland and Labrador	21.7	(1.4)	-1.4	(1.9)	20.3	(1.3)	4.5	(1.7)	24.8	(1.1)	3.1	(1.7)
City												
Victoria	26.5	(1.3)	1.5	(1.8)	28	(1.3)	0.5	(1.8)	28.5	(1.2)	2	(1.8)
Vancouver	29.6	(0.6)	-1.2	(0.8)	28.4	(0.6)	3.8	(0.9)	32.2	(0.7)	2.6	(0.9)
Abbotsford - Mission	27.6	(1.7)	2.8	(2.5)	30.4	(1.9)	4	(2.7)	34.4	(1.9)	6.8	(2.6)
Kelowna		(0)		(0)	28.3	(1.8)	6.3	(2.6)	34.6	(1.9)		(0)
Calgary	23.1	(0.8)	0.5	(1.1)	23.6	(0.8)	1.5	(1.2)	25.1	(0.9)	2	(1.1)
Edmonton	26.6	(0.9)	-0.4	(1.3)	26.2	(0.9)	1.1	(1.2)	27.3	(0.8)	0.7	(1.2)
Saskatoon	26.2	(1.4)	0.6	(1.9)	26.8	(1.3)	1.5	(2)	28.3	(1.5)	2.1	(2)
Regina	22.5	(1.2)	6	(1.9)	28.5	(1.4)	2.1	(2.1)	30.6	(1.5)	8.1	(2)
Winnipeg	25.8	(0.9)	2.9	(1.4)	28.7	(1)	1.9	(1.4)	30.6	(0.9)	4.8	(1.3)
Thunder Bay	33	(1.6)	-5.2	(2.1)	27.8	(1.4)	7.3	(2.3)	35.1	(1.8)	2.1	(2.4)
Greater Sudbury / Grand Sudbury	24.9	(1.3)	1.4	(2)	26.3	(1.5)	3.1	(2.2)	29.4	(1.6)	4.5	(2.1)
Barrie		(0)		(0)	24.1	(1.6)	4.4	(2.1)	28.5	(1.4)		(0)
Windsor	26.8	(1.3)	-2.1	(2)	24.7	(1.6)	0.9	(2.1)	25.6	(1.4)	-1.2	(1.9)
London	25.2	(1)	1.1	(1.5)	26.3	(1.1)	3.1	(1.6)	29.4	(1.2)	4.2	(1.6)
Guelph		(0)		(0)	25.2	(1.5)	4.9	(2.5)	30.1	(2)		(0)
Brantford		(0)		(0)	29.3	(1.7)	3.4	(2.5)	32.7	(1.9)		(0)
Kitchener - Cambridge - Waterloo	26.1	(1.1)	0.6	(1.5)	26.7	(1.1)	2.7	(1.7)	29.4	(1.3)	3.3	(1.7)
St. Catharines - Niagara	27.7	(1.2)	1.3	(2)	29	(1.6)	-2.6	(2.2)	26.4	(1.4)	-1.3	(1.8)
Hamilton	25.8	(0.8)	-2.7	(1.4)	23.1	(1.2)	3.9	(1.5)	27	(1)	1.2	(1.2)
Toronto	27.1	(0.5)	-1.9	(0.7)	25.2	(0.5)	2.6	(0.7)	27.8	(0.5)	0.7	(0.7)
Oshawa	26.4	(1.4)	-2.2	(2)	24.2	(1.4)	3.6	(2.1)	27.8	(1.5)	1.4	(2)
Peterborough		(0)		(0)	29.7	(1.5)	3.5	(2.3)	33.2	(1.7)		(0)
Kingston	26.6	(1.5)	2.6	(2.2)	29.2	(1.6)	4.1	(2.4)	33.3	(1.8)	6.7	(2.4)
Ottawa-Gatineau	25.3	(0.7)	-0.7	(1.1)	24.6	(0.8)	4	(1.2)	28.6	(0.9)	3.3	(1.2)
Montreal	23.6	(0.5)	0.3	(0.7)	23.9	(0.5)	2.1	(0.8)	26	(0.6)	2.4	(0.7)
Trois-Rivires	23.6	(2)	-1.9	(2.5)	21.7	(1.5)	7.6	(2.3)	29.3	(1.7)	5.7	(2.6)
Sherbrooke	20.4	(1.5)	-1.1	(2)	19.3	(1.4)	4.4	(1.9)	23.7	(1.3)	3.3	(1.9)
Quebec	21	(0.8)	-1.3	(1.1)	19.7	(0.9)	3	(1.2)	22.7	(0.9)	1.7	(1.2)
Saguenay	21.9	(1.7)	0.9	(2.4)	22.8	(1.8)	0.4	(2.3)	23.2	(1.5)	1.3	(2.2)
Saint John	29.6	(2)	-4.9	(2.6)	24.7	(1.7)	5.6	(2.5)	30.3	(1.8)	0.7	(2.7)
Moncton		(0)		(0)	32.5	(1.7)	0.9	(2.5)	33.4	(1.8)		(0)
Halifax	23.2	(1.2)	-0.3	(1.8)	22.9	(1.3)	4.7	(1.8)	27.6	(1.2)	4.4	(1.7)
St. Johns	21.7	(1.4)	-1.4	(1.9)	20.3	(1.3)	4.5	(1.7)	24.8	(1.1)	3.1	(1.7)

Change in Rates of Mood Disorder Over Time

	Mood Disorder											
	2001 - 2005		2001-2005 to 2006 - 2011		2006 - 2010		2006 - 2010 to 2011- 2015		2011 - 2015		2001 - 2005 to 2011-2015	
	Prevalence Rate (SE)		Difference in Prevalence Rate (SE)		Prevalence Rate (SE)		Difference in Prevalence Rate (SE)		Prevalence Rate (SE)		Difference in Prevalence Rate (SE)	
Canada	5.3	(0.1)	1.1	(0.1)	6.4	(0.1)	0.9	(0.2)	7.3	(0.1)	2	(0.1)
Province												
British Columbia	6	(0.2)	1.1	(0.4)	7.1	(0.3)	1.3	(0.5)	8.4	(0.3)	2.4	(0.4)
Alberta	6.3	(0.4)	0.3	(0.5)	6.6	(0.4)	0.8	(0.5)	7.4	(0.4)	1.1	(0.5)
Saskatchewan	5.8	(0.4)	2.5	(0.8)	8.3	(0.7)	0.2	(0.9)	8.5	(0.6)	2.7	(0.7)
Manitoba	5.3	(0.4)	2.2	(0.7)	7.5	(0.6)	0.6	(0.8)	8.1	(0.5)	2.8	(0.7)
Ontario	5.6	(0.1)	1.1	(0.2)	6.7	(0.2)	1.2	(0.3)	7.9	(0.2)	2.3	(0.2)
Quebec	4	(0.2)	0.9	(0.3)	4.9	(0.2)	0.1	(0.3)	5	(0.2)	1	(0.3)
New Brunswick	6.9	(0.9)	0.7	(1.1)	7.6	(0.7)	3	(1.1)	10.6	(0.9)	3.7	(1.3)
Nova Scotia	7	(0.7)	1.1	(1.1)	8.1	(0.9)	2.5	(1.1)	10.6	(0.7)	3.6	(1)
Newfoundland and Labrador	5.6	(0.8)	0.6	(1.1)	6.2	(0.7)	2.7	(1.1)	8.9	(0.8)	3.3	(1.2)
City												
Victoria	7.5	(0.6)	1.8	(1)	9.3	(0.8)	1.6	(1.2)	10.9	(0.9)	3.4	(1.1)
Vancouver	5.5	(0.3)	1	(0.4)	6.5	(0.4)	1.4	(0.5)	7.9	(0.4)	2.4	(0.5)
Abbotsford - Mission	8.8	(1.1)	0.1	(1.6)	8.9	(1.2)	0.6	(1.7)	9.5	(1.2)	0.7	(1.6)
Kelowna		(0)		(0)	9.7	(1.6)	1.8	(2)	11.5	(1.1)		(0)
Calgary	5.9	(0.5)	0.8	(0.7)	6.7	(0.6)	0.1	(0.8)	6.8	(0.5)	0.9	(0.7)
Edmonton	6.8	(0.5)	-0.1	(0.7)	6.7	(0.4)	1.4	(0.7)	8.1	(0.6)	1.3	(0.8)
Saskatoon	6.5	(0.6)	2.6	(1.2)	9.1	(1.1)	-0.9	(1.3)	8.2	(0.8)	1.7	(1)
Regina	5.1	(0.6)	2.8	(0.9)	7.9	(0.7)	1	(1.1)	8.9	(0.9)	3.8	(1)
Winnipeg	5.3	(0.4)	2.2	(0.7)	7.5	(0.6)	0.6	(0.8)	8.1	(0.5)	2.8	(0.7)
Thunder Bay	6.2	(0.8)	2	(1.1)	8.2	(0.8)	1.8	(1.2)	10	(1)	3.8	(1.3)
Greater Sudbury / Grand Sudbury	6.4	(0.7)	0.2	(1.1)	6.6	(0.9)	3.2	(1.3)	9.8	(0.9)	3.4	(1.1)
Barrie		(0)		(0)	8.5	(1)	3.3	(1.4)	11.8	(1)		(0)
Windsor	7.7	(0.7)	-0.1	(1)	7.6	(0.7)	0.7	(1.1)	8.3	(0.8)	0.6	(1.1)
London	6.3	(0.5)	2.9	(0.9)	9.2	(0.7)	1.4	(1.1)	10.6	(0.8)	4.3	(0.9)
Guelph		(0)		(0)	7.7	(1)	5.4	(1.7)	13.1	(1.4)		(0)
Brantford		(0)		(0)	9.1	(1)	1.5	(1.5)	10.6	(1.1)		(0)
Kitchener - Cambridge - Waterloo	6.3	(0.5)	1.3	(0.9)	7.6	(0.7)	2.9	(1.1)	10.5	(0.8)	4.2	(1)
St. Catharines - Niagara	6.4	(0.6)	1.1	(1)	7.5	(0.8)	2	(1.2)	9.5	(0.9)	3.1	(1.1)
Hamilton	7.1	(0.4)	1.4	(0.8)	8.5	(0.6)	1.1	(0.9)	9.6	(0.6)	2.5	(0.8)
Toronto	4.7	(0.2)	0.8	(0.3)	5.5	(0.2)	0.7	(0.3)	6.2	(0.2)	1.5	(0.3)
Oshawa	7.2	(0.7)	1.3	(1.2)	8.5	(0.9)	4.1	(1.6)	12.6	(1.3)	5.4	(1.5)
Peterborough		(0)		(0)	8.5	(1.1)	3.6	(1.7)	12.1	(1.3)		(0)
Kingston	7.2	(0.8)	5.8	(1.6)	13	(1.4)	-1	(1.7)	12	(1.1)	4.8	(1.3)
Ottawa-Gatineau	6.5	(0.4)	1.6	(0.7)	8.1	(0.5)	0.8	(0.7)	8.9	(0.5)	2.4	(0.7)
Montreal	4.1	(0.2)	0.8	(0.3)	4.9	(0.3)	0.1	(0.4)	5	(0.2)	0.9	(0.3)
Trois-Rivires	3.4	(0.6)	0.2	(0.9)	3.6	(0.7)	1.6	(1)	5.2	(0.7)	1.8	(1)
Sherbrooke	3.6	(0.7)	2.9	(1.2)	6.5	(1)	-2	(1.1)	4.5	(0.6)	0.9	(0.9)
Quebec	3.5	(0.3)	0.4	(0.5)	3.9	(0.4)	0.3	(0.6)	4.2	(0.4)	0.7	(0.5)
Saguenay	2.8	(0.4)	4.2	(1.2)	7	(1.2)	-1.4	(1.3)	5.6	(0.7)	2.8	(0.8)
Saint John	6.9	(0.9)	-0.2	(1.2)	6.7	(0.8)	4.3	(1.4)	11	(1.2)	4.1	(1.5)
Moncton		(0)		(0)	8.4	(1)	2.2	(1.6)	10.6	(1.2)		(0)
Halifax	7	(0.7)	1.1	(1.1)	8.1	(0.9)	2.5	(1.1)	10.6	(0.7)	3.6	(1)
St. Johns	5.6	(0.8)	0.6	(1.1)	6.2	(0.7)	2.7	(1.1)	8.9	(0.8)	3.3	(1.2)

Change in Rates of Anxiety Disorder Over Time

	Anxiety Disorder											
	2001 - 2005		2001-2005 to 2006 - 2011		2006 - 2010		2006 - 2010 to 2011- 2015		2011 - 2015		2001 - 2005 to 2011-2015	
	Prevalence Rate (SE)		Difference in Prevalence Rate (SE)		Prevalence Rate (SE)		Difference in Prevalence Rate (SE)		Prevalence Rate (SE)		Difference in Prevalence Rate (SE)	
Canada	4.1	(0.1)	1.1	(0.1)	5.2	(0.1)	1.6	(0.1)	6.8	(0.1)	2.7	(0.1)
Province												
British Columbia	4.1	(0.2)	1	(0.3)	5.1	(0.2)	1.4	(0.4)	6.5	(0.3)	2.4	(0.3)
Alberta	3.8	(0.3)	0.7	(0.4)	4.5	(0.3)	1.7	(0.4)	6.2	(0.3)	2.4	(0.4)
Saskatchewan	3.6	(0.4)	1.5	(0.6)	5.1	(0.5)	1.8	(0.7)	6.9	(0.5)	3.3	(0.6)
Manitoba	4.1	(0.4)	1.9	(0.6)	6	(0.5)	1.2	(0.7)	7.2	(0.6)	3.1	(0.7)
Ontario	4.2	(0.1)	1.1	(0.2)	5.3	(0.2)	1.9	(0.3)	7.2	(0.2)	3	(0.2)
Quebec	4.1	(0.2)	1.1	(0.3)	5.2	(0.2)	0.7	(0.3)	5.9	(0.2)	1.8	(0.3)
New Brunswick	5	(0.9)	1.7	(1.1)	6.7	(0.6)	4	(1.1)	10.7	(0.9)	5.7	(1.3)
Nova Scotia	7.3	(1)	-1.8	(1.2)	5.5	(0.7)	5	(1)	10.5	(0.7)	3.2	(1.2)
Newfoundland and Labrador	3.6	(0.5)	2.2	(1)	5.8	(0.8)	4.7	(1.2)	10.5	(0.9)	6.9	(1)
City												
Victoria	5.1	(0.6)	2.1	(0.9)	7.2	(0.7)	0.5	(1.1)	7.7	(0.8)	2.6	(1)
Vancouver	3.8	(0.2)	0.9	(0.3)	4.7	(0.3)	1.4	(0.4)	6.1	(0.3)	2.3	(0.4)
Abbotsford - Mission	5.1	(0.9)	0.2	(1.4)	5.3	(1)	1.7	(1.4)	7	(1)	1.9	(1.3)
Kelowna		(0)		(0)	7.5	(1.4)	1.9	(1.8)	9.4	(1.1)		(0)
Calgary	3.6	(0.3)	0.8	(0.6)	4.4	(0.4)	1.2	(0.6)	5.6	(0.4)	2	(0.6)
Edmonton	4	(0.4)	0.7	(0.5)	4.7	(0.3)	2.4	(0.6)	7.1	(0.5)	3.1	(0.6)
Saskatoon	3.6	(0.5)	2.4	(0.9)	6	(0.8)	1.1	(1)	7.1	(0.7)	3.5	(0.8)
Regina	3.7	(0.6)	0.4	(0.8)	4.1	(0.5)	2.4	(1)	6.5	(0.8)	2.8	(1)
Winnipeg	4.1	(0.4)	1.9	(0.6)	6	(0.5)	1.2	(0.7)	7.2	(0.6)	3.1	(0.7)
Thunder Bay	5.2	(0.7)	0.2	(1)	5.4	(0.7)	2.8	(1)	8.2	(0.8)	3	(1.1)
Greater Sudbury / Grand Sudbury	5.9	(0.7)	-0.3	(0.9)	5.6	(0.7)	5.7	(1.1)	11.3	(0.9)	5.4	(1.1)
Barrie		(0)		(0)	9.3	(1.2)	1.1	(1.6)	10.4	(1.1)		(0)
Windsor	5.3	(0.5)	1.1	(0.8)	6.4	(0.6)	1.2	(1.1)	7.6	(0.8)	2.3	(1)
London	4.1	(0.4)	2.3	(0.8)	6.4	(0.7)	2.3	(1)	8.7	(0.7)	4.6	(0.9)
Guelph		(0)		(0)	5.2	(0.8)	4.9	(1.4)	10.1	(1.2)		(0)
Brantford		(0)		(0)	8.5	(1.1)	0.8	(1.5)	9.3	(1.1)		(0)
Kitchener - Cambridge - Waterloo	4.4	(0.5)	1.1	(0.8)	5.5	(0.6)	4.1	(1.2)	9.6	(1)	5.2	(1.1)
St. Catharines - Niagara	5.5	(0.5)	0.9	(0.9)	6.4	(0.7)	4.4	(1.2)	10.8	(0.9)	5.3	(1.1)
Hamilton	5.9	(0.4)	0.5	(0.7)	6.4	(0.6)	2.7	(0.9)	9.1	(0.7)	3.2	(0.8)
Toronto	3.4	(0.2)	0.8	(0.3)	4.2	(0.2)	1.4	(0.3)	5.6	(0.3)	2.2	(0.3)
Oshawa	5.8	(0.7)	3.1	(1.2)	8.9	(1)	0.3	(1.4)	9.2	(1)	3.4	(1.2)
Peterborough		(0)		(0)	5.9	(0.9)	6.5	(1.9)	12.4	(1.6)		(0)
Kingston	6.5	(0.8)	3.2	(1.5)	9.7	(1.3)	3.1	(1.8)	12.8	(1.3)	6.3	(1.6)
Ottawa-Gatineau	5.3	(0.3)	1.8	(0.6)	7.1	(0.5)	1.2	(0.7)	8.3	(0.5)	3	(0.6)
Montreal	4.1	(0.2)	0.9	(0.3)	5	(0.2)	0.6	(0.3)	5.6	(0.2)	1.5	(0.3)
Trois-Rivires	4.3	(0.6)		(0)		(0)		(0)	6.9	(0.9)	2.6	(1.1)
Sherbrooke	4.5	(0.7)	2.3	(1.2)	6.8	(1)	1.2	(1.3)	8	(0.8)	3.5	(1.1)
Quebec	3.7	(0.4)	1.6	(0.6)	5.3	(0.4)	1	(0.7)	6.3	(0.5)	2.6	(0.6)
Saguenay	4.2	(0.6)	2	(1.1)	6.2	(0.9)	0.3	(1.1)	6.5	(0.6)	2.3	(0.9)
Saint John	5	(0.9)	1.6	(1.2)	6.6	(0.8)	3	(1.5)	9.6	(1.3)	4.6	(1.6)
Moncton		(0)		(0)	6.9	(0.9)	5.3	(1.6)	12.2	(1.3)		(0)
Halifax	7.3	(1)	-1.8	(1.2)	5.5	(0.7)	5	(1)	10.5	(0.7)	3.2	(1.2)
St. Johns	3.6	(0.5)	2.2	(1)	5.8	(0.8)	4.7	(1.2)	10.5	(0.9)	6.9	(1)

Change in Rates of Life Stress Over Time

	Life Stress											
	2001 - 2005		2001-2005 to 2006 - 2011		2006 - 2010		2006 - 2010 to 2011- 2015		2011 - 2015		2001 - 2005 to 2011-2015	
	Prevalence Rate (SE)		Difference in Prevalence Rate (SE)		Prevalence Rate (SE)		Difference in Prevalence Rate (SE)		Prevalence Rate (SE)		Difference in Prevalence Rate (SE)	
Canada	66.6	(0.2)	-1.1	(0.3)	65.5	(0.2)	0	(0.3)	65.5	(0.2)	-1.1	(0.3)
Province												
British Columbia	64.4	(0.4)	-1.8	(0.7)	62.6	(0.6)	0.8	(0.8)	63.4	(0.5)	-1	(0.7)
Alberta	67.9	(0.5)	-1.8	(0.9)	66.1	(0.7)	-0.3	(1)	65.8	(0.6)	-2.1	(0.8)
Saskatchewan	67.2	(0.8)	-6.1	(1.3)	61.1	(1)	3.5	(1.4)	64.6	(0.9)	-2.6	(1.2)
Manitoba	66.2	(0.8)	-1.1	(1.3)	65.1	(1)	-1.3	(1.4)	63.8	(1)	-2.4	(1.2)
Ontario	67.6	(0.3)	-1	(0.5)	66.6	(0.4)	-0.8	(0.5)	65.8	(0.3)	-1.8	(0.4)
Quebec	66	(0.4)	-0.2	(0.6)	65.8	(0.5)	0.9	(0.6)	66.7	(0.4)	0.7	(0.5)
New Brunswick	63.1	(1.4)	-0.7	(1.9)	62.4	(1.3)	0	(1.9)	62.4	(1.3)	-0.7	(1.9)
Nova Scotia	65.5	(1.1)	-4.1	(1.8)	61.4	(1.5)	2.7	(1.9)	64.1	(1.2)	-1.4	(1.6)
Newfoundland and Labrador	62.3	(1.2)	-4.7	(1.9)	57.6	(1.4)	3.7	(2)	61.3	(1.3)	-1	(1.8)
City												
Victoria	63.3	(1)	-0.8	(1.6)	62.5	(1.3)	-1.4	(1.9)	61.1	(1.4)	-2.2	(1.7)
Vancouver	64.6	(0.5)	-1.9	(0.8)	62.7	(0.7)	1.1	(0.9)	63.8	(0.6)	-0.8	(0.8)
Abbotsford - Mission	63.6	(1.8)	-1.8	(2.8)	61.8	(2.1)	2.8	(2.8)	64.6	(1.8)	1	(2.6)
Kelowna		(0)		(0)	61.1	(1.9)	-1.1	(2.8)	60	(2.1)		(0)
Calgary	68.4	(0.7)	-2.5	(1.2)	65.9	(1)	-0.5	(1.3)	65.4	(0.9)	-3	(1.2)
Edmonton	67.5	(0.7)	-1.4	(1.2)	66.1	(1)	0.2	(1.4)	66.3	(1)	-1.2	(1.2)
Saskatoon	66.5	(1.1)	-6.3	(1.8)	60.2	(1.4)	2.9	(1.9)	63.1	(1.3)	-3.4	(1.8)
Regina	68.1	(1)	-5.6	(1.8)	62.5	(1.5)	3.9	(2)	66.4	(1.3)	-1.7	(1.6)
Winnipeg	66.2	(0.8)	-1.1	(1.3)	65.1	(1)	-1.3	(1.4)	63.8	(1)	-2.4	(1.2)
Thunder Bay	65.7	(1.2)	-0.1	(1.8)	65.6	(1.2)	-3	(2)	62.6	(1.6)	-3.1	(2.1)
Greater Sudbury / Grand Sudbury	64.7	(1.3)	-1.6	(2)	63.1	(1.6)	-0.8	(2.3)	62.3	(1.6)	-2.4	(2)
Barrie		(0)		(0)	68.2	(1.8)	2.2	(2.3)	70.4	(1.5)		(0)
Windsor	67	(1)	-0.1	(2)	66.9	(1.7)	-4	(2.5)	62.9	(1.8)	-4.1	(2.1)
London	67.9	(0.8)	-3.4	(1.5)	64.5	(1.3)	1.1	(1.6)	65.6	(1)	-2.3	(1.3)
Guelph		(0)		(0)	68.5	(1.6)	-1.5	(2.3)	67	(1.7)		(0)
Brantford		(0)		(0)	67.3	(1.9)	0	(2.3)	67.3	(1.3)		(0)
Kitchener - Cambridge - Waterloo	68.4	(0.9)	-2.4	(1.6)	66	(1.3)	2.1	(1.8)	68.1	(1.2)	-0.3	(1.5)
St. Catharines - Niagara	64.8	(1)	-1.7	(1.7)	63.1	(1.4)	-1.4	(1.9)	61.7	(1.3)	-3.1	(1.6)
Hamilton	66.1	(0.7)	-1.6	(1.2)	64.5	(1)	-1.2	(1.4)	63.3	(1)	-2.8	(1.3)
Toronto	68.2	(0.4)	-1.2	(0.7)	67	(0.5)	-0.6	(0.7)	66.4	(0.5)	-1.8	(0.6)
Oshawa	66.2	(1.1)	0.2	(1.8)	66.4	(1.5)	1.8	(2.1)	68.2	(1.5)	2	(1.8)
Peterborough		(0)		(0)	62.1	(2.2)	0.2	(3.1)	62.3	(2.2)		(0)
Kingston	65.9	(1.6)	0.1	(2.5)	66	(1.9)	0.9	(2.5)	66.9	(1.6)	1	(2.3)
Ottawa-Gatineau	67.5	(0.7)	-0.6	(1.1)	66.9	(0.9)	-1.9	(1.2)	65	(0.8)	-2.5	(1.1)
Montreal	66.2	(0.4)	0.4	(0.7)	66.6	(0.6)	1.4	(0.8)	68	(0.5)	1.8	(0.7)
Trois-Rivires	61.7	(1.6)	1.8	(2.5)	63.5	(1.9)	-1.7	(2.6)	61.8	(1.8)	0.1	(2.4)
Sherbrooke	66.9	(1.3)	-4.8	(2.3)	62.1	(1.8)	2.9	(2.4)	65	(1.5)	-1.9	(2)
Quebec	65.3	(0.7)	-0.5	(1.3)	64.8	(1.1)	-2.3	(1.4)	62.5	(0.9)	-2.8	(1.2)
Saguenay	63.1	(1.3)	-3.5	(2.2)	59.6	(1.8)	1.9	(2.3)	61.5	(1.5)	-1.6	(2)
Saint John	63.1	(1.4)	-0.6	(2.3)	62.5	(1.8)	-0.1	(2.6)	62.4	(1.8)	-0.7	(2.3)
Moncton		(0)		(0)	62.3	(1.8)	1.3	(2.6)	63.6	(1.8)		(0)
Halifax	65.5	(1.1)	-4.1	(1.8)	61.4	(1.5)	2.7	(1.9)	64.1	(1.2)	-1.4	(1.6)
St. Johns	62.3	(1.2)	-4.7	(1.9)	57.6	(1.4)	3.7	(2)	61.3	(1.3)	-1	(1.8)

Appendix H: Mental Health Resources

Crisis Services Canada: 1-833-456-4566 (& chat and text options)
First Nations and Inuit Hope for Wellness Help Line: 1-855-242-3310
Kids Help Phone : 1-800-668-6868 (chat options)
Problem Gambling Helpline: 1-800-306-6789
Saskatchewan Health line: 811
Saskatoon Child and Youth Services: 306-655-7777
Saskatoon Community Addiction Services (Adult): 306-655-7777
Saskatoon Community Adult Mental Health Services: 306-655-7777
Saskatoon Crisis Intervention Services (Mobile Crisis 24 hrs): 306-933-6200
Trans Lifeline (Transgender Helpline): 1-877-330-6366

In case of psychiatric emergencies, please go to the Royal University Hospital Adult Emergency Department or for youth, the Jim Pattison Children's Hospital Emergency Department. The Emergency room is open 24 hours per day.